LLL 8080 Basic Interpreter Program

PART II

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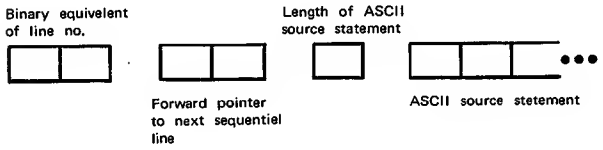
INTRODUCTION

This article is part #2 of a series of four articles covering the LLL 8080 BASIC Interpreter program released to the public domain by Lawrence Livermore Laboratories. This article covers the description of the BASIC Interpreter and includes the assembly listing of the LLL 8080 BASIC Interpreter program.

DESCRIPTION OF BASIC INTERPRETER

Following is a brief description of the BASIC interpreter. Hopefully, with this description, it will not be a major project to modify the BASIC to satisfy the reader's specific needs.

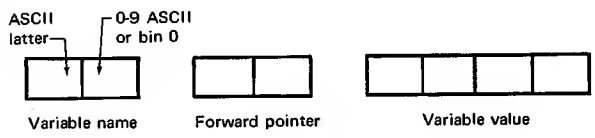
Formats — Source statements are stripped of blanks on input (character strings enclosed in " "s are an exception) and stored as is in memory, using the following format:



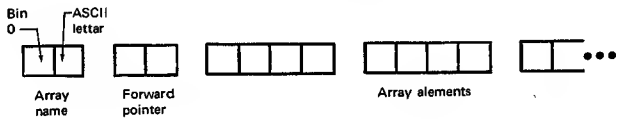
The forward pointer links statements by ascending line numbers. The last line's forward pointer (supposedly an end statement) has value 177777_8 to indicate end of the list.

The symbol table is built up at run time and begins after the most recently entered source statement (the variable STSPAC points to where the symbol table will start). Symbol table entries are shown below:

SCALAR-VARIABLE FORMAT



ARRAY-VARIABLE FORMAT



Subroutines — Following is a list of potentially useful subroutines, with a brief description of each subroutine:

ALPHA — Value pointed to by H and L is tested to see if it is an ASCII letter.
CY = 1 => Yes
CY = 0 => No

NUMB — Same as above but tests for a decimal number (ASCII 0-9).

CHAR2 — Inputs a character from the teletype to a register.

CHAR5 — Same as above for HSR (High Speed Paper Tape Reader).

CHK1 — Checks to see if HL are equal to 177777_8 (−1).
CY = 1 => Yes
CY = 0 => No.

CONV (CVRT) — One of the floating-point routines. Converts floating-point number to a character string. Output is padded to the output buffer.

COPDH — Copies floating-point number pointed to by D, E to location pointed to by H, L; uses copy.

COPY — One of the floating-point routines. Copies floating-point value pointed to by A, L to location pointed to by H, C.

CUB — Converts the integer-character string pointed to by H, L to its binary equivalent. Vale returns in D, E registers.

DCOMP — Double-byte comparison routine. Compares value in CB to the value in ED.

Z = 1 => CB = ED
CY = 1 => CB > ED
CY = 0 => CB < ED.

DFXL — One of the floating-point routines. Used to float an unsigned integer H, L point to first of four bytes; integer is right justified in first three bytes.

EVAL — Evaluates an expression the first element of which is pointed to by H, L and the length of which is in C. Used to evaluate expressions wherever they are legal in BASIC. C usually contains the length of the source statement line containing the expression.

FINPT — One of the floating-point routines. Converts character string to floating-point number. The variable HLINP contains a pointer to the character string, and the variable CREG contains the length of line containing character string. Mode = 0 => data comes from teletype (i.e., only delimiters are g's). Mode = 1 => data comes from source statements.

FIX — Fixes a floating-point number. DE points to number to be fixed. Error code 13 is given if number is too big to fix.

FSYM — Finds symbols in symbol table. BC contains symbol. Returns with HL pointing to symbol value.
CY = 1 => symbol was found.
CY = 0 and a scalar => symbol not found, but inserted and initialized to 0.
CY = 0 and an array => not found, no action taken: HL are meaningless.

LADD — Floating-point add routine.

LSUB — Floating-point subtract routine.

LOIU — Floating-point divide routine.

LMUL — Floating-point multiply routine.

LMCM — One of the floating-point routines. Compares two floating-point values, HL Point to first floating-point values and HB point to second floating-point value.
z =1 => Equality
Cy=1 => first < second
(Note: compares absolute only, does not reference mantissa sign.)

MCHK — Waits for flag from port 3. Proper mask is sent in register B.

MEMFUL — Checks to see if memory is full. HL point to location of memory to be checked. Memory is considered full if it is within 50_{10} locations of the current value of stack pointer.

MULT — Multiplies two two-byte binary numbers. HL point to last byte of four bytes. First two contain first number. Last two contain second number. Answer returns in BCDE.

NSRCH — Routine to locate source line in memory passed binary value of line number in DE. Returns address of line in HL, CY=1 => not found.

OUTR — Used by CONV (CURT) to pad output to output buffer.

PAD — Pads characters to output buffer. A contains character; B contains number of pads.

SYMSRT — Checks a character string to see if it is a BASIC symbol. HL contains address pointing to 1st character of symbol, C contains length of line that contains symbol. A contains type of symbol sought.
0=command 1=keyword
z=operator or delimiter 3=function

Returns with 377_8 in a register if nothing found. Otherwise A contains symbol number in appropriate KDAT table. Thus, for symbol type 2, if a 4 is returned, the symbol found was the fourth one (starting with 0) in table KDAT3 (KDAT concatenated with 2 and 1 or A'). CIS is updated, but HL is not.

TTYIW — Inputs a line from teletype. Stores starting address at location pointed to by HL. Line edits. Returns length of line in A register (maximum line length is 72 characters).

VALUE — Called with HL pointing to A variable, constant, or function; C contains line length, returns with DE pointing to floating-point value. HL, C are updated.

VAR — Called with HL pointing to character string, C has line length. Determines if character string is a variable. If so, returns with CY=1, DE pointing to value (subscripts of arrays are evaluated, etc.). HL, C updated. If not, a variable returns CY=0, HL, C untouched.

WRIT — Dumps contents of output buffer to teletype. Uses entry WRIT1 with. D register equal to one to suppress CR/LF.

ZROL — Part of floating-point subroutines. Writes a floating-point zero, starting at location pointed to by HL.

The preceding list contains those subroutines most likely to be used by someone modifying BASIC. If you plan on using one of the routines, you should examine it and its comments carefully.

Variables — Following is a list of interpreter variables, with a description of each variable:

MEMST — Assembly time variable. Contains the first available RAM location. This is where active variables start.

MEMEND — Assembly time variable. Contains the last available location in RAM.

SEND — Has value 6, used with RST instruction to print characters via ODT.

OBUFF — Output buffer, the first location contains the number of characters in the buffer + 1.

IBUF — Input buffer, occupies same area as OBUFF.

STLINE — Points to first source line to be executed. If no source, contains 177777_8.

NLINE, NL2, NL4, NL6 — Contain address, binary-equivalent line number, forward pointer, and length of next input line.

KLINE, KL2, KL4, KL6 — Same as above, but used by a subroutine that inserts lines in sequential order (insert).

PLINE, PL2, PL4, PL6 — Subroutine insert to order statements sequentially.

KASE, LEN — Temporary storage for command mode routines.

MULT1, MULT2 — Used to store binary values to be multiplied.

SBSAV — Temporary storage for call-statement processor.

STSPAC — Next available location in memory, symbol table starts here at run time.

LPNT — Pointer to the current line at run time.

CPNT — Pointer to current character in current line at run time.

KFPNT — Point to next sequential line at run time.

FREG1, FREG2 — Two floating-point registers.

HLINP, CREG — Temporary storage for HL and C registers for routine INP.

NXTSP — Pointer to next available space of memory for symbol table.

GREG — General register, in and out instructions are stored here and executed for get and put functions.

MODE — Indicates to INP routine whether input data comes from source or teletype.

MESCR — Temporary storage for call-statement processor. Points to next available space after symbol table. Area after the symbol table is used to store intermediate results of expressions or constants passed to user subroutines.

VARAD — Temporary storage space for input-statement processor.

VEND — Assembly time variable. Indicates end of interpreter variable-storage area and where FWAM pointer is to go.

FWAM — First word of available memory pointer. This is where user source programs go.

Some of the above variables occupy the same area of memory. This is because some variables are used only in the command mode and others only at runtime. To conserve space, they share the same memory locations.

New BASIC Statements — To add additional statements to the BASIC, use the following procedure. First, insert the statement keyword in the data tables for subroutine SYMSRT. Then, insert the starting address of the statement processor in the interpreter JUMP table. Finally, the statement processor itself must be inserted.

The keyword must be entered in the table KDAT2. The first byte must be the keyword length and the next bytes hold the ASCII-coded keyword. The table must end with A 377_8. If the keyword is the Nth entry in the table, on return from SYMSRT, the A register will hold N-1 if the keyword is found.

The starting address of the statement processor must be inserted into table JTBL. The order of keywords in KDAT2 must correspond with statement processor addresses in JTBL since, on return from SYMSRT, the A register times two is used as offset in JTBL to determine processor address.

The statement processor must be placed somewhere in memory. Generally, the first thing done in the statement processors is to load the pointer to the statement (LHLD CPNT) and increment past the keyword (since HL is not updated by SYMSRT). On entry, C contains the number of characters in the line minus those checked by SYMSRT. The end of the processor should be a "JMPIEND" instruction.

New Functions — New functions must be added to SYSSRT Data Table KDAT4 in the same manner as for key words. The function itself must be placed in subroutine "VALUE." Presently, the only function in VALUE is GET.

Message Lines — The following description tells how to incorporate messages into BASIC output routines. Currently, to output a message to the teletype, the user executes an LXI H,ODATA, then a call to FORMK where K is an integer indicating which message is wanted (i.e., K=z indicates "TURN ON PUNCH"). FORM pads the message into the output buffer. Then A "CALL WRIT" writes the contents of the buffer.

Suppose the message "POTATO BASIC" is to be added. Preceding the form 9 instruction, we will insert "FOR10: INR L." At the end of the ODATA table, we

add "DB ODAT8 and 377Q.". And, after message ODAT 7, we add ODAT8 DB *12, "POTATO BASIC." Now, the following program segment:

```
LXI   H,ODATA
CALL  FOR10
CALL  WRIT.
```

will cause "POTATO BASIC" to be output to the teletype.

SEE MICROCOMPUTER SOFTWARE DEPOSITORY PROGRAM INDEX FOR COPIES OF THIS PROGRAM

```
8080 MACRO ASSEMBLER, VER 2.1  ERRORS = 0

                        ;
                        ;       BAS80 - BASIC INTERPRETER FOR INTEL 8080 MICRO-PR
                        ;
                        ;         WRITTEN AT THE UNIVERSITY OF IDAHO BY:
                        ;
                        ;           GERALD R. BARBER
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                        ;           JOHN A. TEETER
                        ;           EAST OF CASCADE
                        ;           SOUTH OF LANDMARK
                        ;           DEADWOOD, IDAHO
                        ;
                        ;           JOHN W. DICKINSON
                        ;           DEPT. OF ELECTRICAL ENGINEERING
                        ;           UNIVERSITY OF IDAHO
                        ;           MOSCOW, IDAHO
                        ;
                        ;
                        ;       THIS FILE CONTAINS THE EDIT AND EXECUTION PORTION
                        ;       OF THE BASIC INTERPRETER.  IT IS DESIGNED TO EXEC
                        ;       WITH THE COMPANION FILE CONTAINING THE FLOATING
                        ;       POINT ROUTINES.
                        ;
                        ;       I/O IS ACCOMPLISHED WITH A TTY AND A HIGH SPEED
                        ;       PAPER TAPE READER.  TTY I/O IS DONE THROUGH
                        ;       OUT ROUTINES.  PAPER TAPE INPUT IS HANDLED
                        ;       MANUALY.
                        ;
                        ;       DEFINE LINKAGES FROM FLT PNT PACKAGE TO I/O ROUTINES
                        ;
OFFA                            ORG     7772Q
OFFA  C3 73 19          INP:    JMP     INP
OFFD  C3 8B 1F          OUTR:   JMP     OUTR
                        ;
                        ;       DEFINE ADDRESSES OF ACTIVE VARIABLES
                        ;
2100                    MEMST   EQU     2040QQ          ;MUST BE ON PAGE BOUNDA
27FF                    MEMEND  EQU     23777Q          ;END OF RAM MEMORY
0006                    SEND    EQU     6               ;RST FOR OUT
2100                    OBUFF   EQU     MEMST           ;INPUT AND OUTPUT BUFFE
2101                    IBUF    EQU     MEMST+1         ;SAME AREA
2140                    STLINE  EQU     MEMST+111Q      ;STARTING LINE OF USER PRO
2148                    NLINE   EQU     MEMST+113Q      ;POINTER TO NEW LINE OF
214D                    NL2     EQU     MEMST+115Q      ;BINARY VALUE OF NEW LI
214F                    NL4     EQU     MEMST+117Q      ;FORWARD POINTER OF NEW
                        ;
2151                    NL6     EQU     MEMST+121Q      ;LENGTH OF NEW LINE
2152                    KLINE   EQU     MEMST+122Q      ;POINTER TO CURRENT LIN
2154                    KL2     EQU     MEMST+124Q      ;BINARY EQU. OF CURRENT
2156                    KL4     EQU     MEMST+126Q      ;FORWARD POINTER OF CUR
2158                    KL6     EQU     MEMST+130Q      ;LENGTH OF NEW LINE
2159                    PLINF   EQU     MEMST+131Q      ;PREVIOUS LINE POINTER-
215B                    PL2     EQU     MEMST+133Q      ;BINARY LINE NUMBER OF
215D                    PL4     EQU     MEMST+135Q      ;FORWARD POINTER OF PRE
215D                    SBSAV   EQU     PL4             ;RETURN ADD. SAVE FOR C
215F                    PL6     EQU     MEMST+137Q      ;LENGTH OF PREVIOUS LIN
2160                    KASF    EQU     MEMST+140Q      ;SPARE STURAGE USED AS
2161                    LFM     EQU     MEMST+141Q      ;ALSO SPARE-LFTEM LENGT
2162                    MULT1   EQU     MEMST+142Q      ;FIRST OF TWO WORDS USE
2164                    MULT2   EQU     MEMST+144Q      ;SECOND WORD
2159                    NXTSP   EQU     PLINE           ;POINTER TO NEXT AVAILA
214A                    STSPAC  EQU     NLIME           ;START OF SYM. TABLE
3FCD                    ZRDL    EQU     7715Q           ;FLOATING PNT. ROUTINE
2152                    LPNT    EQU     KLINE           ;SOURCE LINE PTR DURING
2158                    KLEN    EQU     KL6             ;SPARE USED AS NEEDED
2158                    CPNT    EQU     PL2             ;CHAR. PTR DURING EXEC.
2156                    KFPNT   EQU     KL4             ;FWD LINE PTR DURING EX
2800                    FREG2   EQU     MEMST+200Q      ;FLOATING POINT REG. #2
2184                    CREG    EQU     MEMST+204Q      ;TEMP. SPACE FOR MULTIN
0FUU                    LAUD    EQU     7720Q           ;FLUATING PUINT ROUTINE
0FD3                    LMUL    EQU     7723Q           ;FLOATING POINT ROUTINE
0FD6                    LDIV    EQU     7726Q           ;FLOATING POINT ROUTINE
0F09                    LSUB    EQU     7731Q           ;FLUATING PUINT ROUTINE
0F0C                    DFXL    EQU     7734Q           ;FLOATING POINT ROUTINE
0F0F                    LMCM    EQU     7737Q           ;FLOATING POINT ROUTINE
2186                    HLIMP   EQU     MEMST+206Q      ;TEMP. SPACE FOR ROUTIN
2171                    GREG    EQU     MEMST+167Q      ;GENERAL PURPOSE REGIST
217C                    FREG1   EQU     MEMST+174Q      ;FLUATING PNT. REGISTER
2146                    SCR     EQU     MEMST+146Q      ;SCRATCH AREA FOR I/O R
0FE5                    CONV    EQU     7745Q           ;FLOATING PNT. OUTPUT R
2185                    MODF    EQU     MEMST+205Q      ;MODE FLAG FOR ROUTINE
0FEB                    FINDT   EQU     7753Q           ;FLOATING PNT. INPUT RO
0FEB                    MULT    EQU     7753Q           ;ADD. VALUE MULT. ROUTI
0FEF                    PTVAL   EQU     7756Q           ;DEFINE LPNT,KFPNT ETC.
0FF1                    DCOMP   EQU     7761Q           ;DOUBLE BYTE COMPARISON
0FF4                    MCHK    EQU     7764Q           ;CHECK MASK
0FF7                    CHAR2   EQU     7767Q           ;INPUT CHAR. FROM TTY
2188                    MESCR   EQU     MEMST+210Q      ;DEFINE MEMORY SCR AREA
218C                    VARAQ   EQU     MEMST+212Q      ;TEMP SPACE FOR INP. ST
2190                    VNAME   EQU     MEMST+214Q      ;TEMP SPACE FOR *FOR-NE
218E                    VLOC    EQU     MEMST+216Q      ;TEMP SPACE FOR *FOR-NE
2190                    FLIMT   EQU     MEMST+220Q      ;TEMP SPACE FOR *FOR-NE
2194                    MEST    EQU     MEMST+224Q      ;NESTING STACK-POINTER
2196                    STAC    EQU     MEMST+226Q      ;FOR-NEXT NESTING STACK
0014                    STSIZ   SET     20              ;STACK SIZE, ALLOWS 10
2196                    TOPNS   EQU     STAC            ;TOP OF STACK
21AA                    BOTNS   EQU     STAC+STSIZ      ;BOTTOM OF STACK
                        ;
21AA                    VEND    EQU     MEMST+252Q      ;DEF. END OF VAR. STORA
                        ;
                        ;       DEFINE FWA MEMORY AND START OF SUBTABLE
                        ;
21AA                            ORG     VEND
21AA  AD 21             FWAM:   DW      SCHEM
21AC  FF                SUBS:   DB      377Q            ;NOTHING IN SUB TABLE
21AD                    SCHEM   EQU     $
                        ;
                        ;       MAIN ROUTINE--HANDLES ALL USER INPUT
                        ;
1000                            ORG     10000Q
                        ;
1000  21 00 21          M1:     LXI     H,OBUFF         ;INITIALIXE THE OUTPUT
1003  36 01                     MVI     M,1             ;TO HAVE LENGTH ONE.
1005  21 49 21                  LXI     H,STLINE        ;PUT -1 INTO STLINE
1008  36 FF                     MVI     M,377Q
100A  2C                        INR     L
100B  36 FF                     MVI     M,377Q          ;-1 IS ALWAYS END OF LI
100D  2A AA 21                  LHLD    FWAM            ;GET ADDRS OF FWA MEM.
1010  22 48 21                  SHLD    NLINE           ;STORE IN FREE SPACE PN
1013  21 F5 27          M1A:    LXI     SP,MEMEND-10    ;SET STACK TO HIGH MEMO
1016  21 5A 14          M2:     LXI     H,ODATA         ;LENGTH OF ODATA (ASCII
1019  CD 48 14                  CALL    FORMI           ;PAD "READY."
101C  CD 00 12                  CALL    WRIT
101F  2A 48 21          H3:     LHLD    NLINE           ;GET NEXT LINE FOR ACCE
1022  23                        INX     H
1023  23                        INX     H               ;MOVE PAST POINTERS TO
1024  23                        INX     H
1025  23                        INX     H
1026  23                        INX     H
1027  CD C9 13                  CALL    TTYIN           ;GET INPUT FROM TTY
102A  4F                        MOV     C,A             ;MOVE NUMBER OF CHAR TO
102B  FE U0                     CPI     0               ;IS IT 0
102D  CA 1F 10                  JZ      M3              ;YEP SO TRY AGAIN
1030  CD 22 12                  CALL    ALPHA           ;IS INPUT AN ALPHA STRI
1033  DA 42 10                  JC      M4              ;YEP--GO  DECIMAL NUMER
1036  CD 14 12                  CALL    NUM8            ;IS INPUT A NUMERIC STR
1039  04 9E 11                  CNC     WHAT            ;NOPE -- FIND OUT WHATS
103C  CD 8F 10                  CALL    INSERT          ;YEP-- GO INSERT NEW LI
103F  C3 1F 10                  JMP     M3              ;LOOP ON PROCESS
1042  3E 00              H4:     MVI     A,0             ;SET UP SYMBOL TYPE A=0
1044  CD F7 12                  CALL    SYMSRT          ;GO FIND COMMAND
1047  3C                  M4A:    INR     A
1048  CC 9E 11                  CZ      WHAT            ;REG. A RETURNED WITH -
1048  3D                        DCR     A
104C  CA 78 16                  JZ      RUN             ;ITS A RUN COMMAND
104F  3D                        DCR     A
1050  CC AA 11                  CZ      TAPE            ;THE DUDE WANTS A PLST
1053  CA 16 10                  JZ      M2
1056  3D                        DCR     A
1057  CC U1 11                  CZ      LIST            ;HE WANTS A LISTING
105A  CA 16 10                  JZ      M2
105D  3D                        DCR     A
105E  CA 00 10                  JZ      M1              ;IT WAS A PURGE COMMAND
1061  3D                        DCR     A
1062  C4 9E 11                  CNZ     WHAT            ;IF ITS NOT ZERO--THEN
                                                        ;ELSE ITS PTAPE
```

```
                        ;
                        ;       ROUTINE TO INPUT FROM HSR
                        ;       THIS CONDITION IS DEFAULT VAL
                        ;
1065  CD 08 15          PTAPE:  CALL    CHARS           ;GET CHAR. FROM READER
1068  FE 0D                     CPI     0               ;IS IT LEADER?
106A  CA 65 10                  JZ      PTAPE           ;YEP -- WAIT FOR GOOD I
106D  CD U5 14          PT1:    CALL    INSRIN          ;GOT CHAR.
1070  4F                        MOV     C,A
1071  FE 0D                     CPI     0               ;IS IT STILL LEADER?
1073  CA 65 10                  JZ      PTAPE           ;YEP-- KEEP WAITING
1076  CD 22 12                  CALL    ALPHA           ;IS IT ALPHA STRING?
1079  DA 42 10                  JC      M4              ;YEP-- SO GO INTERPRET
107C  CD 8F 10                  CALL    INSERT          ;NOPE--SO GO INSERT IT
107F  CD 08 15                  CALL    CHARS           ;GET NEXT CHAR.
1082  FE 0D                     CPI     0               ;IS IT LEADER?
1084  CA 16 10                  JZ      M2              ;YEP--GO BACK TO KEYBOA
1087  23                        INX     H
1088  23                        INX     H               ;MOVE PAST POINTERS OF
1089  23                        INX     H
108A  23                        INX     H
108B  23                        INX     H
108C  C3 6D 10                  JMP     PT1             ;LOOP ON PROCESS
                        ;
                        ;       ROUTINE TO HANDLE ALL SOURCE LINE INPUT.
                        ;       THIS INCLUDES INSERTION, DELEATION, AND
                        ;       ADDITION OF NEW SOURCE LINES.
                        ;
1DBF  2B                INSERT: DCX     H               ;THE ROUTINE SORTS LINI
1090  71                        MOV     M,C             ;THE TEXT USING THE FOR
1091  23                        INX     H               ;STORED IN THE TABLE.
1092  CD 2A 12                  CALL    EVAL            ;GET BINARY FOR NEW LIN
1095  FE 05                     CPI     5               ;IS IT MIN. VALUE?
1097  DA A2 10                  JC      ISRIA           ;ITS A VALID NOMBER
109A  C4 9E 11                  CNZ     WHAT            ;IMVALID MUMBER--REPORT
109D  78                        MOV     A,E
109E  17                        RAL
109F  DC 9E 11                  CC      WHAT
10A2  2A 4B 21          ISRIA:  LHLD    NLIMF           ;POINT TO NEW LINE
10A5  72                        MOV     M,D
10A6  23                        INX     H
10A7  73                        MOV     M,E
10A8  21 4B 21                  LXI     H,NLINE
10AB  CD EL DF                  CALL    PTVAL           ;FIMD THE POINTER VALUE
10AE  2A 49 21                  LHLD    STLINE          ;GET START OF SOURCE
10B1  CD A3 12                  CALL    CHK1            ;CHECK FOR NO TEXT
10B4  D2 D4 10                  JNC     ISRT3           ;THERE IS SOMETHING-STA
10B7  2A 4B 21                  LHLD    NLINE           ;THIS IS FIRST LINE
10BA  22 49 21                  SHLD    STLINE          ;MOVE NLINE TO STLINE
10BD  16 FF             ISRTI:  MVI     D,377Q          ;SET UP -1 FOR END OF L
10BF  5A                        MOV     E,D
10C0  CD 8F 11                  CALL    STPNT           ;STORE IT AWAY IN POINT
10C3  23                        INX     H
10C4  7E                ISRT2:  MOV     A,M             ;GETLINE LENGTH
10C5  C6 05                     ADI     5               ;ADJUST TO LEN+5
10C7  2A 4B 21                  LHLD    NLINE
10CA  85                        ADD     L
10CB  6F                        MOV     L,A
10CC  3E 00                     MVI     A,0
10CE  8C                        ADC     H
10CF  67                        MOV     H,A
10D0  22 4B 21                  SHLD    NLINE           ;STEP PAST NEW LINE
10D3  C9                        RET
10D4  22 52 21          ISRT3:  SHLD    KLINE           ;SET UP CURRENT LINE
10D7  21 52 21          ISRT4:  LXI     H,KLINE         ;GET CURRENT LINE AND
10DA  CD EE 0F                  CALL    PTVAL           ;SET UP POINTERS
10DD  21 40 21                  LXI     H,NL2           ;GET BINARY VALUE
10E0  56                        MOV     D,M             ;OF NEW LINE
10E1  2C                        INR     L
10E2  5E                        MOV     E,M
10E3  21 54 21                  LXI     H,KL2           ;GET CURRENT LINE BINAR
10E6  46                        MOV     B,M
10E7  2C                        INR     L
10E8  4E                        MOV     C,M
10E9  CD F1 0F                  CALL    UCOMP           ;HOW DO THEY COMPARE?
10EC  CA 21 11                  JZ      ISRT6           ;REPLACE/DELETE
10EF  DA 7A 11                  JC      ISR12           ;KLINE>NLINE
10F2  2A 56 21                  LHLD    KL4             ;MOVE ON TO NEXT LINE
10F5  CD A3 12                  CALL    CHK1            ;ARE WE DONE?
10F8  DA 0F 11                  JC      ISRT5
10FB  E5                        PUSH    H
10FC  2A 52 21                  LHLD    KLIME
10FF  22 59 21                  SHLD    PLIMF           ;SET UP PREVIOUS LINE
1102  21 59 21                  LXI     H,PLINE
1105  CD EE 0F                  CALL    PTVAL           ;SET POINTERS
1108  E1                        POP     H
1109  22 52 21                  SHLD    KLINE           ;SET UP CURRENT LINE
110C  C3 07 10                  JMP     ISRT4           ;LOOP ON PROCESS
110F  2A 48 21          ISRT5:  LHLD    NLINE           ;GET NLINE ADDRESS
1112  CD 91 11                  CALL    NOLINE          ;IS IT 0 LEN. LINE?
1115  C8                        RZ                      ;YES-DO NOTHING
1116  EB                        XCHG
1117  2A 52 21                  LHLD    KLINE           ;GET CURRENT LINE
111A  CD 8F 11                  CALL    STPNT           ;STORE AWAY POINTERS
111D  EB                        XCHG
111E  C3 8D 10                  JMP     ISRTI           ;GO SET END OF LIST
1121  2A 48 21          ISRT6:  LHLD    NLINE           ;REPLACE OR DELETE
1124  CD 91 11                  CALL    NOLINE          ;NOLINE MEANS DELETE
1127  C2 48 11                  JNZ     ISRT8           ;GO REPLACE IF NOT 0
112A  2A 49 21                  LHLD    STLINE          ;GET STLINE
112D  EB                        XCHG
112E  2A 52 21                  LHLD    KLINE           ;IF STLINE=KLINE THEN L
1131  E5                        PUSH    H               ;NOW ZERO
1132  E1                        POP     H
1133  CD F1 0F                  CALL    DCOMP
1136  2A 56 21                  LHLD    KL4
1139  CA 44 11                  JZ      ISRTT           ;IF NOT STLINE THEN GO
113C  EB                        XCHG
113D  2A 59 21                  LHLD    PLINE
1140  CD 8F 11                  CALL    STPNT
1143  C9                        RET
1144  22 49 21          ISRTT:  SHLD    STLINE
1147  C9                        RET
1148  2A 56 21          ISRT8:  LHLD    KL4             ;REPLACE LINE
114B  EB                        XCHG
114C  2A 4B 21                  LHLD    NLINE
114F  CD 8F 11                  CALL    STPNT
1152  2A 52 21          ISRT9:  LHLD    KLINE
1155  EB                        XCHG
1156  2A 49 21                  LHLD    STLINE
1159  E5                        PUSH    H
115A  C1                        POP     B
115B  CD F1 0F                  CALL    DCOMP
115E  CA 71 11                  JZ      ISR11           ;IF KLINE =STLINE GOTO
1161  2A 4B 21                  LHLD    NLINE
1164  EB                        XCHG
1165  2A 59 21                  LHLD    PLINE
1168  CD 8F 11                  CALL    STPNT           ;PREVIOUS LINE PNTS. TO
116B  21 51 21                  LXI     H,NL6           ;SET UP NEW LINE TO
116E  C3 C4 10                  JMP     ISRT2           ;POINT TO NLKL4I
1171  2A 4B 21          ISR11:  LHLD    NLINE           ;NLINE=STLINE
1174  22 49 21                  SHLD    STLINE
1177  C3 68 11                  JMP     ISRTI
117A  2A 52 21          ISR12:  LHLD    KLINE           ;NLINE IN FRONT OF KLIN
117D  EB                        XCHG
117E  2A 4B 21                  LHLD    NLINE
1181  CD 91 11                  CALL    NOLINE
1184  C8                        RZ
1185  CD 8F 11                  CALL    STPNT
1188  C3 52 11                  JMP     ISRT9
                        ;
                        ;       ROUTINE TO STORE POINTERS INTO MEM ARRAY
                        ;       HL CONTAIN ADDR. OF FIRST WORD OF ENTRY.
                        ;       THE CORESPONDING ELEMENTS HL2,HL4,HL6I CONTAIN
                        ;       THE NEW ENTRIES.
                        ;
118B  23                STPNT:  INX     H
118C  23                        INX     H
118D  73                        MOV     M,E             ;MOVE HL2/NL2/PL2 INTO
118E  23                        INX     H
118F  72                        MOV     M,D
1190  C9                        RET
                        ;
                        ;       ROUTINE TO CHECK NEW LINE FOR SOURCE STMT.
                        ;
1191  F5                NOLINE: PUSH    H
1192  23                        INX     H
1193  23                        INX     H
1194  23                        INX     H
1195  23                        INX     H
1196  4E                        MOV     C,M             ;MOVE LENGTH OF LINE IN
1197  23                        INX     H
1198  CD 71 12                  CALL    LEMGTH          ;POINT TO FIRST CHAR.
119B  F1                        POP     H
119C  B9                        CMP     C               ;COMPARE LEN TO C
119D  C9                        RET
```

```
                        ;  ROUTINE TO RESPOND WITH 'WHAT?' FOR UNIDENTIFIED
                        ;  COMMAND.
                        ;
119E  21 5A 14          WHAT:   LXI     H,DUATA         ;GET OUTPUT BUFFER ADDR
11A1  CD 44 14                  CALL    FORM7           ;PAD IT
11A4  CD DD 12                  CALL    WRIT            ;DUMP IT
11A7  C3 13 10                  JMP     MIA             ;JUMP TO RESTART.
                        ;
                        ;  RCUTINE TO PUNCH PAPER TAPE OF SOURCE.
                        ;  CALLED IN RESPONSE TO TAPE COMMAND
                        ;
11AA  F5                TAPE:   PUSH    PSW
11AB  C5                        PUSH    B
11AC  21 5A 14                  LXI     H,DUATA         ;GET OUTPUT BUFFER ADDR
11AF  CD 47 14                  CALL    FORM2           ;PAD IN TURN ON PUNCH
11B2  CD DD 12                  CALL    WRIT            ;DUMP IT
11B5  3E 00                     MVI     A,0             ;SET UP TO DUMP LEADER
11B7  C1                        POP     B
11B8  06 4D                     MVI     B,100Q
11BA  F5                        PUSH    PSW
11BB  C5                        PUSH    B
11BC  CD AD 12                  CALL    PAD             ;PAD 100 D'S
11BF  CD DD 12                  CALL    WRIT
11C2  C1                        POP     B
11C3  C5                        PUSH    B
11C4  CD D1 11                  CALL    LIST            ;GO DL STANDARD LIST
11C7  C1                        POP     B
11C8  F1                        POP     PSW
11C9  CD AD 12                  CALL    PAD             ;GO PAD AND DUMP TRAILE
11CC  CD DD 12                  CALL    WRIT
11CF  F1                        POP     PSW
11D0  C9                        RET
                        ;
                        ;  ROUTINE TO LIST TO TTY THE SOURCE STMTS.
                        ;  ALSO USED TO DUMP TAPE.
                        ;  ALLOWS THE USER TO INPUT FIRST LINE OF
                        ;  OR FIRST AND LAST LINES.
11D1  2A 49 21          LIST:   LHLD    STLINE
11D4  CD A3 12                  CALL    CHK1            ;CHECK FOR NO SOURCE
11D7  DA 13 10                  JC      MIA             ;GO RESTART
11DA  22 59 21                  SHLD    PLINE           ;SET UP TO START LOOKIN
11DD  21 FF FF                  LXI     H,1777770
11E0  22 52 21                  SHLD    KLINE
11E3  0D                        DCR     C
11E4  C4 4D 15                  CNZ     BOUN1           ;GO FIND FIRST LINE
11E7  2A 59 21                  LHLD    PLINE           ;STORE IT AWAY
11EA  23                LISI:   INX     H
11EB  23                        INX     H
11EC  46                        MOV     B,M
11ED  23                        INX     H               ;GET LEN. IN REG B
11EE  4E                        MOV     C,M
11EF  C5                        PUSH    B
11F0  23                        INX     H
11F1  CD 49 14                  CALL    FORM            ;GO PAD LINE
11F4  CD 00 12                  CALL    WRIT            ;GO DUMP LINE
11F7  C1                        POP     B
11F8  2A 52 21                  LHLD    KLINE           ;CHECK FOR LAST LINE
11FB  EB                        XCHG
11FC  CD F1 0F                  CALL    DCOMP
11FF  C8                        RZ
1200  68                        MOV     L,B
1201  61                        MOV     H,C             ;MOVE TO NEXT LINE
1202  CD 08 12                  CALL    QUITT           ;CHECK FOR INTERRUPTION
1205  C3 EA 11                  JMP     LISI            ;NONE - CONTINUE
                        ;
                        ;  THIS ROUTINE CHECKS PORT 2 FOR A CNTRL/S CHARACTER
                        ;  IF ONE IS FOUND THEN EXECUTION IS TO BE INTERRUPTED
                        ;  CONTROL IS PASSED TO MIA
                        ;
1208  DB 03             QUITT:  IN      3               ;TEST FLAG PORT
120A  1F                        RAR                     ;FLAG TO CY
120B  D0                        RNC                     ;NOTHING THERE
120C  DB 02                     IN      2               ;FLAG WAS SET, GET DATA
120E  FE 93             QTCHK:  CPI     2230            ;WAS IT CNTRL/S?
1210  CA 13 10                  JZ      MIA             ;YES
1213  C9                        RET                     ;NO, RETURN
                        ;
                        ;  ROUTINES NUMB AND ALPHA CHECK IF CONTENTS OF MEMORY
                        ;  LOCATION IN HL CONTAIN ASCII NUMERIC OR ALPHABETIC
                        ;  CHARACTER. RETURN CY=1 IF YES, CY=0 IF NO.
                        ;
1214  C5                NUMB:   PUSH    B
1215  06 80                     MVI     B,2600          ;SET UP ASCII 0
1217  0E 6A                     MVI     C,272Q
1219  7E                E1:     MOV     A,M
121A  B8                        CMP     B
121B  3F                        CMC
121C  D2 20 12                  JNC     BAC
121F  B9                        CMP     C
1220  C1                BAC:    POP     B
1221  C9                        RET
1222  C5                ALPHA:  PUSH    B
1223  06 C1                     MVI     B,3010          ;SET UP ASCII A
1225  0E DB                     MVI     C,333Q
1227  C3 19 12                  JMP     E1
                        ;
                        ;  ROUTINE TO CONVERT ASCII NUMERIC CHAR. STRING TO
                        ;  EQUIVALENT BINARY NUMBER. RETURNS EQUIVALENT IN
                        ;  DE REG. LENGTH OF LINE PASSED IN REG C AND
                        ;  RETURNED POINTING TO LAST NUMERIC CHAR. LENGTH
                        ;  OF CHAR STRING RETURNED IN REG A.
                        ;
122A  E5                CVB:    PUSH    H
122B  E5                        PUSH    B
122C  CD 71 12                  CALL    LENGTH          ;GET LENGTH OF STRING
122F  F5                        PUSH    PSW
1230  E5                        PUSH    H
1231  FE 00                     CPI     0               ;IS LENGTH=0?
1233  CA 68 12                  JZ      CVB2            ;YEP--GO TO CVB2
1236  21 60 21                  LXI     H,XASF          ;SET UP TEMP VAR XASE
1239  77                        MOV     M,A             ;SAVE LENGTH IN XASE
123A  2C                        INR     L               ;SET UP TO MULT. BY
123B  71                        MOV     M,C             ;DEC IO
123C  21 DA 00                  LXI     H,10
123F  22 62 21                  SHLD    MULTI
1242  21 00 00                  LXI     H,0
1245  22 64 21                  SHLD    MULT2
1248  21 65 21                  LXI     H,MULT2+1
124B  CD E0 0F          CVB1:   CALL    MULT
124E  E3                        XTHL
124F  7E                        MOV     A,M             ;GET NEXT CHAR, AND
1250  DE B0                     SBI     2600            ;STRIP ASCII FROM IT
1252  82                        ADD     D               ;THE CONVERSION ALGORIT
1253  57                        MOV     D,A
1254  3E 00                     MVI     A,0             ;DE?0
1256  8B                        ADC     E               ;DO WHILE A>0
1257  5F                        MOV     E,A             ;    DE?(HLIM)-26DB)+0
1258  23                        INX     H               ;    END;
1259  E3                        XTHL
125A  7A                        MOV     A,D
125B  2C                        INR     L
125C  73                        MOV     M,E
125D  E5                        PUSH    H
125E  21 61 21                  LXI     H,LEN
1261  35                        DCR     M
1262  2D                        DCR     L
1263  35                        DCR     M
1264  E1                        POP     H
1265  C2 4B 12                  JNZ     CVB1
1268  F1                CVB2:   POP     H               ;THE PROCESS IS COMPLET
1269  F1                        POP     PSW             ;  RESULT IN DE
126A  C1                        POP     B
126B  21 61 21                  LXI     H,LEN
126E  4F                        MOV     C,M
126F  F1                        POP     H
1270  C9                        RET
                        ;
                        ;  ROUTINE TO EVALUATE LENGTH OF ASCII NUMERIC
                        ;  CHAR. STRING: PASSED ADD OF FIRST CHAR IN HL REG.
                        ;  RETURNS LENGTH IN REG A.
                        ;
1271  C5                LENGTH: PUSH    B               ;SAVE REGISTERS
1272  E5                        PUSH    H
1273  06 00                     MVI     B,0             ;INITIALIZE REG B
1275  CD 14 12          NLE1:   CALL    NUMB            ;IS HL(M) AN ASCII NUMB
1278  D2 84 12                  JNC     NLE2            ;NO DONE- REG B CONTAIN
127B  23                        INX     H               ;YEP- GET NEXT ONE
127C  04                        INR     B
127D  0D                        DCR     C               ;CHECK FOR END OF LINE
127E  CA 84 12                  JZ      NLE2
1281  C3 75 12                  JMP     NLE1            ;LOOP ON PROCESS
1284  78                NLE2:   MOV     A,B             ;MOVE LENGTH INTO A
1285  E1                        POP     H
1286  D1                        POP     D
1287  C9                        RET
                        ;
                        ;  ROUTINE TO LOCATE SOURCE LINE IN MEM, PASSED BIN VALUE
                        ;  OF LINE NUMBER IN UP(LOW,HIGH) REG. RETURNS ADDRESS OF
                        ;  SOURCE LINE IN HL REGS.(HIGH,LOW). CY SET=> NOT FOUND.
                        ;
1288  2A 49 21          NSRCH:  LHLD    STLINE          ;GET FIRST LINE
128B  CD A3 12          L2:     CALL    CHK1            ;IS IT -1 (END OF LIST)
128E  D8                        RC                      ;YES- NO SOURCE-RETURN
128F  46                        MOV     B,M             ;MOVE LINE NUMB. INTO B
1290  23                        INX     H
1291  4E                        MOV     C,M
1292  CD F1 0F                  CALL    DCOMP           ;HOW DO THEY COMPARE?
1295  CA A0 12                  JZ      FOUND
1298  23                        INX     H               ;BUMP HL TO GET POINTER
1299  7E                        MOV     A,M
129A  23                        INX     H
129B  66                        MOV     H,M             ;MOVE TO NEXT LINE AND
129C  6F                        MOV     L,A
129D  C3 88 12                  JMP     L2
12A0  28                FOUND:  DCX     H               ;MATCH--POINT TO FIRST
12A1  B7                        ORA     A
12A2  C9                        RET
                        ;
                        ;  ROUTINE TO COMPARE CONTENTS OF HL TO 1777770.
                        ;  RETURNS CY=1 IF YES: CY=0 IF NO.
12A3  C5                CHK1:   PUSH    B               ;SAVE REGISTERS
12A4  E5                        PUSH    H
12A5  06 00                     MVI     B,0             ;MOVE 1 INTO BC
12A7  0E 01                     MVI     C,1
12A9  09                        DAD     B               ;DOUBLE ADD TO SET STAT
12AA  E1                        POP     H
12AB  C1                        POP     B
12AC  C9                        RET
                        ;
                        ;  ROUTINE TO PAD OUTPUT BUFFER WITH CONTENTS OF REG A.
                        ;  REG B CONTAINS NUMBER OF CHAR TO PAD.
                        ;
12AD  C5                PAD:    PUSH    B               ;SAVE REGISTERS
12AE  D5                        PUSH    D
12AF  E5                        PUSH    H
12B0  21 0D 21                  LXI     H,OBUFF         ;GET OBUFF ADDRESS
12B3  40                        MOV     C,L             ;POINT TO PROPER ENTRY
12B4  6E                        MOV     L,M
12B5  57                        MOV     D,A
12B6  3E 49                     MVI     A,73            ;CHECK FOR LINE LENGTH
12B8  B0                P1:     CMP     L
12B9  C2 C2 12                  JNZ     P2              ;ROOM LEFT--GO FILL
12BC  69                        MOV     L,C             ;OBUFF IS FULL- AUTO PR
12BD  77                        MOV     M,A
12BE  CD 00 12                  CALL    WRIT
12C1  2C                        INR     L               ;RE-INITIALIZE L
12C2  72                P2:     MOV     M,D
12C3  2C                        INR     L
12C4  05                        DCR     B               ;DECREMENT NUMB. CHAR.
12C5  C2 B8 12                  JNZ     P1              ;GO TO P1 IF ANY LEFT
12C8  7A                        MOV     A,D             ;RESTORE PROPER STATUS
12C9  45                        MOV     B,L
12CA  69                        MOV     L,C
12CB  70                        MOV     M,B
12CC  E1                        POP     H
12CD  D1                        POP     D
12CE  C1                        POP     B
12CF  C9                        RET
                        ;
                        ;  ROUTINE TO DUMP OUTPUT BUFFER TO TTY.
                        ;
1200  16 00             WRIT:   MVI     Q,0
1202  F5                WRIT1:  PUSH    PSW
1203  C5                        PUSH    B
1204  E5                        PUSH    H
1205  21 00 21                  LXI     H,OBUFF         ;GET OBUFF ADDR.
1208  F5                        PUSH    H
1209  4E                        MOV     C,M             ;GET NUMB. OF CHAR.
120A  0D                        DCR     C               ;IS OBUFF EMPTY
120B  CA F0 12                  JZ      W2
120E  2C                        INR     L
120F  7F                W1:     MOV     A,M             ;MOVE CHAR.
1210  F7                        RST     SEND            ;PRINT VIA OUT
1211  2C                        INR     L               ;MOVE TO NEXT CHAR.
1212  0D                        DCR     C
1213  C2 0F 12                  JNZ     W1
1216  15                        DCR     D
1217  CA F0 12                  JZ      W2
121A  3E 8D                     MVI     A,215Q          ;PUT OUT CR, LF.
121C  F7                        RST     SEND            ;PRINT VIA OUT
121D  3E 8A                     MVI     A,212Q
121F  F7                        RST     SEND            ;PRINT VIA OUT
1220  E1                W2:     POP     H
1221  36 01                     MVI     M,1
1223  C1                        POP     B
1224  E1                        POP     H
1225  F1                        POP     PSW
1226  C9                        RET
                        ;
                        ;  ROUTINE TO LOCATE COMMANDS, KEY WORDS, OPERATORS,
                        ;  AND FUNCTIONS.  HL CONTAINS ADD OF FIRST CHAR.;
                        ;  REG C CONTAINS LENGTH OF LINE: RETURNS SYMBOL NUMBER
                        ;  IF FOUND IN REG A. 377Q IN A IF NOT FOUND.
                        ;  ON ENTRY REG. A CONTAINS TYPE OF ENTRY SOUGHT:
                        ;
                        ;    0 FOR COMMAND
                        ;    1 FOR KEYWORD
                        ;    2 FOR OPERATOR AND DELIMITER
                        ;    3 FOR FUNCTION
                        ;
1227  D5                SYMSRT: PUSH    Q
1228  C5                        PUSH    B
1229  E5                        PUSH    H
122A  E5                        PUSH    H
122B  21 61 21                  LXI     H,LEN           ;SAVE C IN LEN
122E  71                        MOV     M,C
122F  21 48 13                  LXI     H,XDATA
1232  1E 00                     MVI     E,0
1234  85                        ADD     L
1235  6F                        MOV     L,A
1236  6F                        MOV     L,M
1237  4E                S2:     MOV     C,M
1238  2C                S3:     INR     L               ;LEN IN C AND BUMP L
1239  46                        MOV     B,M             ;FIRST CHAR. IN B
123A  E3                        XTHL                    ;FIRST CHAR OF USER STR
123B  7E                        MOV     A,M             ;AND COMPARE
123C  B8                        CMP     B
123D  C2 23 13                  JNZ     S4              ;NO MATCH-TRY AGAIN
1240  0D                        DCR     C               ;SET UP FOR NEXT CHAR
1241  CA 3F 13                  JZ      S5              ;IF DONE EXIT
1244  E5                        PUSH    H
1245  21 61 21                  LXI     H,LEN           ;DECREMENT LINE LENGTH
1248  35                        DCR     M
1249  E1                        POP     H
124A  CA 22 13                  JZ      S4A             ;IF 0 THEN MOVE ON
124D  23                        INX     H               ;REPEAT PROCESS
124E  E3                        XTHL
124F  C3 08 13                  JMP     S3
1252  0C                S4A:    INR     C
1253  F1                S4:     POP     H               ;GET ADDR. OF TABLE
1254  79                        MOV     A,C
1255  85                        ADD     L
1256  94                        SUB     D,H
1257  F1                        POP     H
1258  C1                        POP     B
1259  C5                        PUSH    B
125A  E5                        PUSH    H
125B  F5                        PUSH    H
125C  21 61 21                  LXI     H,LEN           ;SET UP PROPER ENTRY
125F  71                        MOV     M,C             ;POINT TO PROPER ENTRY
1260  0F                        MOV     L,A
1261  62                        MOV     H,D
1262  7E                        MOV     A,M
1263  1C                        INR     E
1264  4F                        MOV     C,A
1265  3C                        INR     A
1266  C2 08 13                  JNZ     S3
1269  21 61 21                  LXI     H,LEN
126C  34                        INR     M
126D  1E FF                     MVI     E,377Q          ;E=-1 IF NO MATCH
126F  7B                S5:     MOV     A,E             ;MOVE SYMBOL NUMBER INT
1270  21 61 21                  LXI     H,LEN
1273  5E                        MOV     E,M
1274  1D                        DCR     E
1275  F1                        POP     H
1276  F1                        POP     H
1277  C1                        POP     B
1278  4B                        MOV     C,E             ;MOVE NUMBER OF CHAR. L
1279  D1                        POP     D
127A  C9                        RET
                        ;
                        ;*****************************************************
                        ;THE CODE FROM HERE TO THE NEXT LINE OF **S MUST BE ON UN
                        ;
127B  4F                KDATA:  DB      KDAT1 AND 377Q
127C  44                        DB      KDAT2 AND 377Q
127D  9E                        DB      KDAT3 AND 377Q
127E  C0                        DB      KDAT4 AND 377Q
127F  03 D2 05 CE       KDAT1:  DB      3,322Q,325Q,316Q        ;RUN
1283  03 DD CC D3               DB      3,335Q,314Q,323Q        ;PLS
1287  03 CC C9 D3               DB      3,314Q,311Q,323Q        ;LIS
128B  03 D3 C3 D2               DB      3,323Q,303Q,322Q        ;SCR
128F  03 D0 C1 C1               DB      3,320Q,301Q,301Q        ;PTA
1293  FF                        DB      377Q
1294  03 CC C5 D4       KDAT2:  DB      3,314Q,305Q,324Q        ;LET
1298  03 DU D2 C9               DB      3,325Q,322Q,311Q        ;PRI
129C  03 D2 C5 CU               DB      3,322Q,305Q,315Q        ;REM
12A0  03 D3 D4 CF               DB      3,323Q,324Q,317Q        ;STU
12A4  03 C5 CE C4               DB      3,305Q,316Q,304Q        ;END
12A8  03 C7 CF D4               DB      3,307Q,317Q,324Q        ;GOT
12AC  02 C9 C6                  DB      2,311Q,306Q             ;IF
12AF  03 C9 CE DQ               DB      3,311Q,316Q,320Q        ;INP
12B3  03 C4 C9 CD               DB      3,304Q,311Q,315Q        ;DIM
12B7  03 C3                     DB      3,1C1+2000              ;CAL
12B9  C1                        DB      *A1+2000
12BA  CC                        DB      *L1+2000
12BB  04 C7                     DB      4,1G1+2000              ;GOSU
12BD  CF                        DB      *O1+2000
12BE  D3                        DB      *S1+2000
12BF  D5                        DB      *U1+2000
12C0  03 Q2                     DB      3,*R1+2000              ;RET
12C2  C5                        DB      *E1+2000
12C3  04                        DB      4,*T1+2000
12C4  03 C6                     DB      3,*F1 OR 2000           ;FOR
```

```
1396  CF                    DB      'O' OR 200Q
1397  D2                    DB      'R' OR 200Q
1398  D4 CE                 DB      4,'N' OR 200Q     ;NEXT
139A  C5                    DB      'E' OR 200Q
1398  D8                    DB      'X' OR 200Q
139C  D4                    DB      'T' OR 200Q
139D  FF                    DB      377Q
                      ;
                      ;DELIMITERS HAVE FOLLOWING VALUES:
                      ;
                      ;       <       0
                      ;       >       1
                      ;       '       2
                      ;       =       3
                      ;       )       4
                      ;       -       5
                      ;       THEN    6
                      ;       TO      7
                      ;       STEP    8
                      ;       *       9
                      ;       /       10
                      ;
                      ;       +       11
                      ;       -       12
                      ;
139F  01 BC 01 BE     KDAT3:  DB      1,274Q,1,276Q     ;'<','>'
13A2  01 AC 01 BD             DB      1,254Q,1,275Q     ;',','='
13A6  01 A9                   DB      1,251Q            ;')'
13AB  01 B0                   DB      1,'0'+200Q        ;'-'
13AA  04                      DB      4                 ;THEN
13AB  04                      DB      'T' OR 200Q
13AC  CB                      DB      'H' OR 200Q
13AD  C5                      DB      'E' OR 200Q
13AE  CE                      DB      'N' OR 200Q
13AF  02                      DB      2                 ;TO
13B0  D4                      DB      'T' OR 200Q
13B1  CF                      DB      'O' OR 200Q
13B2  04                      DB      4                 ;STEP
13B3  D3                      DB      'S' OR 200Q
13B4  D4                      DB      'T' OR 200Q
13B5  C5                      DB      'E' OR 200Q
13B6  D0                      DB      'P' OR 200Q
13B7  01 AA                   DB      1,'*'+200Q        ;'*'
13B9  01 AF 01 AB             DB      1,257Q,1,253Q     ;'/','+'
13BD  01 AD                   DB      1,255Q            ;'-'
13BF  FF                      DB      377Q
13C0  03 C7 C6 04     KDAT4:  DB      3,307Q,305Q,3240  ;GET
13C4  03 0D 05 04             DB      3,3200,3250,3240  ;PUT
13C8  FF                      DB      377Q
                      ;
                      ;*****************************************************
                      ; ROUTINE TO INPUT SOURCE LINE FROM TTY. PASSED ADD
                      ; OF FIRST CHAR IN HL. RETURNS LENGTH OF LINE IN REG A
                      ;
13C9  F5              TTYIN:  PUSH    H
13CA  06 00                   MVI     B,0
13CC  CD F7 0F        TIN1:   CALL    CHAR2
13CF  FE 99                   CPI     231Q              ;CNTRL Y?
13D1  CA 01 14                JZ      TIN5
13D4  FF FF                   CPI     377Q              ;RUBOUT?
13D6  CA F6 13                JZ      TIN2
13D9  FE DF                   CPI     337Q              ;BACK ARROW (RUBOUT)?
13DB  CA F9 13                JZ      TIN2+3
13DE  FE BA                   CPI     212Q              ;LF?
13E0  CA CC 13                JZ      TIN1
13E3  FE 8D                   CPI     215Q              ;CR
13E5  CA 0B 14                JZ      TIN4
13E8  FE 8C                   CPI     214Q              ;FORM FEED?
13EA  CA CC 13                JZ      TIN1              ;IGNORE
13ED  77              TIN4:   MOV     M,A
13EE  23                      INX     H
13EF  04                      INR     B
13F0  CD 14 15                CALL    MEMFUL
13F3  C3 CC 13                JMP     TIN1
13F6  3E DF           TIN2:   MVI     A,337Q
13F8  E7                      RST     SEND              ;PRINT VIA ODT
13F9  2B                      DCX     H
13FA  05                      DCR     B
13FB  F2 CC 13                JP      TIN1
13FE  E1                      POP     H
13FF  AF                      XRA     A                 ;ZERO A
1400  C9                      RET
1401  3E 0C           TIN5:   MVI     A,334Q
1403  E7                      RST     SEND              ;PRINT VIA ODT
1404  3E 00           TIN5A:  MVI     A,0
1406  F1                      POP     H
1407  C9                      RET
1408  3E 8A           TIN4:   MVI     A,212Q
140A  E7                      RST     SEND              ;PRINT VIA ODT
140B  3E 00           TIN4A:  MVI     A,0
140D  E1                      POP     H
140E  78                      MOV     A,B
140F  B9                      CMP     C
1410  C8                      RZ
                      ;
                      ; ROUTINE TO REMOVE BLANKS FROM SOURCE UNLESS ENCLOSED IN
                      ;
1411  D5                      PUSH    D                 ;SAVE REG'S
1412  E5                      PUSH    H
1413  C5                      PUSH    H
1414  1E A2                   MVI     E,'"'+200Q        ;INIT E FOR COMPARES
1416  1E 00                   MVI     D,0               ;D=1=>WITHIN QUOTES, LE
1418  AF            PK1:      XRA     A                 ;CLEAR A
1419  BA                      CMP     D                 ;CHECK INPUT MODE
141A  7E                      MOV     A,M               ;GET CHAR
141B  C2 2A 14                JNZ     QSTR.             ;WITHIN QUOTE STRING
141E  BB                      CMP     E                 ;IS IT 1ST "?
141F  C2 20 14                JNZ     $+7               ;NO - PROCEED
1422  14                      INR     D                 ;YES, SET FLAG
1423  C3 30 14                JMP     QSTRI             ;CONTINUE
1426  FE A0           QSTR:   CPI     240Q              ;IS IT A SPACE?
1428  CA 30 14                JZ      PK2               ;YES - LEAVE OUT
142B  BB              QSTRG:  CMP     E                 ;2ND "?
142C  C2 30 14                JNZ     $+4               ;NO - CONTINUE
142F  15                      DCP     D                 ;RESET FLAG
1430  E3            QSTRI:  XTHL                      ;GET DESTINATION ADDRES
1431  77                    MOV     M,A               ;SAVE
1432  23                    INX     H                 ;BUMP PNTR.
1433  E3                    XTHL
1434  0C                    INR     C                 ;BUMP CHAR. CNT
1435  23            PK2:    INX     H                 ;BUMP PNTR.
1436  05                    DCR     B                 ;DCR INPUT LINE CHAR CN
1437  C2 18 14              JNZ     PK1               ;MORE - GO AGAIN
143A  79                    MOV     A,C               ;CHAR CNT TO A
143B  F1
143C  F1                    POP     H                 ;RESTORE REG'S, RETURN
143D  D1                    POP     H
143E  C9                    POP     D
                            RET
                      ;
                      ; ROUTINES TO  PAD MESSAGES TO  OUTPUT BUFFER.
                      ; FORI2 PADS 'UNDERFLIW'
                      ; FORII PADS 'OVERFLOW'
                      ; FORIO PADS 'ZERODIVIDE'
                      ; FORM9 PADS 'INPUT ERROR, TRY AGAIN'
                      ; FORM8 PADS 'MEMORY FULL'
                      ; FORM7 PADS 'WHAT?'
                      ; FORM6 PADS 'IN LINE'
                      ; FORM3 PADS 'ERROR'
                      ; FORM2 PADS 'TURN ON PUNCH'
                      ; FORM1 PADS 'READY'
                      ; FORM5 PADS SOURCE LINE, PASSED ADDRESS OF
                      ; LENGTH OF LINE IN HL REGS.
                      ; FORM6 PADS CHAR STRING, PASSED ADD OF FIRST CHAR IN
                      ; HL, LENGTH OF STRING IN REG C
                      ;
143F  2C              FORI2:  INR     L                 ;THE ENTRY POINT INCREM
1440  2C              FORII:  INR     L                 ;PROPER DATA POINT
1441  2C              FORIO:  INR     L
1442  2C              FORM9:  INR     L
1443  2C              FORM8:  INR     L
1444  2C              FORM7:  INR     L
1445  2C              FORM4:  INR     L
1446  2C              FORM3:  INR     L
1447  2C              FORM2:  INR     L
1448  6F              FORM1:  MOV     L,M               ;POINT TO PROPER BUFFER
1449  4F              FORM5:  MOV     C,M               ;MOVE LENGTH INTO C
144A  79                      MOV     A,C               ;AND STORE IN A
144B  FE 00                   CPI     0                 ;IS IT 0?
144D  C8                      RZ
144E  23              FI:     INX     H                 ;INCREMENT TO GET FIRST
144F  0E              FORM6:  MOV     A,M               ;THE PAD LOOP
1450  06 01                   MVI     B,1
1452  CD AD 12                CALL    PAD
1455  0D                    DCR     C
1456  C2 4F 14                JNZ     FI
1459  C9                    RET
                      ;
                      ;*****************************************************
                      ; THE CODE FROM HERE TO THE NEXT LINE OF **S MUST BE ON O
                      ;
145A  64              ODAIA:  DB      ODAIT AND 377Q
145B  6A                      DB      ODAI2 AND 377Q
145C  78                      DB      ODAI3 AND 377Q
145D  81                      DB      ODAI4 AND 377Q
145E  88                      DB      ODAI5 AND 377Q
145F  91                      DB      ODAI6 AND 377Q
1460  A0                      DB      ODAI7 AND 377Q
1461  B7                      DB      ODAI8 AND 377Q
1462  C2                      DB      ODAI9 AND 377Q
1463  CB                      DB      ODAIO AND 377Q
1464  05 52 45 41   UDAT1:   DB      5,'READY'
1468  44 59
146A  0D 54 55 52   UDAT2:   DB      13,'TURN ON PUNCH'
146E  4E 20 4F 4E
1472  20 50 55 4E
1476  43 48
1478  0B 80 BA 45   DDAT3:   DB      8,215Q,212Q,'ERROR '
147C  52 52 4F 52
1480  20
1481  0D 20 49 4E   UDAT4:   DB      9,' IN LINE '
1485  20 4C 49 4E
1489  45 20
148B  05 57 48 41   DDAT5:   DB      5,'WHAT?'
148F  54 3F
1491  0E 4D 45 4D   UDAT6:   DB      14,'MEMORY FULL',215Q,212Q,'?'
1495  4F 52 59 20
1499  46 55 4C 4C
149D  0D 8A 3F
14A0  16 49 4E 50   DDAT7:   DB      22,'INPUT EPROR, TRY AGAIN'
14A4  55 54 20 45
14A8  52 52 4F 52
14AC  2C 20 54 52
14B0  59 20 41 47
14B4  41 49 4E
14B7  0A 49 4E 44   DDAT8:   DB      10,'INDEFINITE'
14BB  45 46 49 4E
14BF  49 54 45
14C2  08 4F 56 45   UDAT9:   DB      8,'OVERFLOW'
14C6  52 46 4C 4F
14CA  57
14CB  09 55 4E 44   DDA10:   DB      9,'UNDERFLOW'
14CF  45 52 46 4C
1403  4F 57
                      ;
                      ;*****************************************************
                      ; ROUTINE TO INPUT SOURCE LINE FROM HSR. PASSED ADD
                      ; OF FIRST CHAR IN HL. RETURNS LENGTH OF LINE IN REG A
                      ;
14D5  E5              HSRIN:  PUSH    H                 ;SAVE ADDR.
14D6  06 00                   MVI     B,0               ;INIT. NUMB. OF CHAR. R
14D8  C3 DE 14                JMP     PIN1A
14DB  CD 08 15        PIN1:   CALL    CHAR5             ;GET A CHAR.
14DE  FE 99           PIN1A:  CPI     231Q              ;CNTRL Y?
14E0  CA 04 14                JZ      TIN5A
14E3  FE FF                   CPI     377Q              ;DEL?
14E5  CA 00 15                JZ      PIN3
14E8  FE DF                   CPI     337Q              ;CNTR A?
14EA  CA 03 15                JZ      PIN3
14ED  FE 8A                   CPI     212Q              ;CR?
14EF  CA 0A 14                JZ      TIN4A
14F2  FE BD                   CPI     215Q              ;CR?
14F4  CA DA 14                JZ      PIN1
14F7  77              PIN2:   MOV     M,A               ;GOOD CHAR--STORE IT AW
14F8  23                      INX     H                 ;MOVE TO NEXT SLOT
14F9  04                      INR     B
14FA  CD 14 15                CALL    MEMFUL            ;IS MEM. FULL?
14FD  C3 DB 14                JMP     PIN1              ;LUOP ON PROCESS
1500  2B              PIN3:   DCX     H                 ;DELETE THE LAST CHAR.
1501  05                    DCR     B                 ;MUST INSURE THE LINE I
1502  F2 DB 14              JP      PIN1
1505  F1                    POP     H
1506  AF                    XRA     A
1507  C9                    RET                       ;ZERO A
                      ;
                      ; ROUTINE TO INPUT CHAR FROM HSR
                      ;
1508  C5              CHAR5:  PUSH    B
1509  06 04                 MVI     B,4               ;THE INPUT REQUEST
150B  D3 05                   OUT     5
150D  CD F4 0F                CALL    MCHK              ;GO GET CHAR.
1510  DB 05                 IN      5                 ;THE TERMINATE REQUEST
1512  C1                    POP     B
1513  C9                    RET
                      ;
                      ; ROUTINE TO INSURE SOURCE DOES NOT OVERFLOW MEM SPACE
                      ; COMPARES CURRENT MEM ADDRESS TO SP.
                      ;
1514  C5              MEMFUL: PUSH    B                 ;SAVE REG.B,D,H
1515  D5                    PUSH    D
1516  E5                    PUSH    H
1517  3E 32                 MVI     A,50              ;MOVE DEC 50 INTO B TO
1519  85                    ADD     L                 ;INSURE MARGINE OF STAC
151A  47                    MOV     B,A
151B  3E 00                 MVI     A,0
151D  8C                    ADC     H
151E  4F                    MOV     C,A               ;ESTABLISH MEM+50 IN BC
151F  21 00 00              LXI     H,0
1522  39                    DAD     SP                ;MOVE SP INTO HL
1523  55                    MOV     D,L
1524  5C                    MOV     E,H               ;SET UP FOR DCOMP
1525  CD FI 0F              CALL    DCOMP
1528  E1                    POP     H
1529  01                    POP     D
152A  C1                    POP     B
152B  D0                    RNC
152C  21 5A 14              LXI     H,ODATA           ;CY=0 THEN OK TO CONTIN
152F  CD 43 14              CALL    FORM8             ;MEMORY FULL--PAD
1532  CD D0 12              CALL    WRIT              ;MESSAGE AND WRITE
1535  CD F7 0F              CALL    CHAR2             ;GET USER RESPONCE
1538  CD AD 12              CALL    PAD               ;MUST BE 1,2 OR 3 FOR C
153B  CD 00 12              CALL    WRIT
153E  DE B0                 SBI     260Q
1540  FE 04                 CPI     4
1542  CC 9E 11              CZ      WHAT              ;IMPROPER RESPONCE
1545  31 F5 27              LXI     SP,MEMEND-10      ;RESET SP
1548  0E 01                 MVI     C,1
154A  C3 47 10              JMP     M4A               ;LOOP ON CONTROL SECTID
                      ;
                      ; ROUTINE TO EVALUATE BOUNDS FOR LIST AND PLIST
                      ; COMMANDS. RETURNS PLINE AS FIRST LINE, MEINE
                      ; AS LAST LINE TO BE LISTED.
                      ;
1540  2A 4B 21        BOUND:  LHLD    NLINE             ;GET ADDR. OF NEW LINE
1543  3E 09                 MVI     A,9
1545  85                    ADD     L                 ;INCREMENT 9 TO GET TO
1546  6F                    MOV     L,A
1547  3E 00                 MVI     A,0
1549  8C                    ADC     H
154A  67                    MOV     H,A               ;THE ADDR. IS NOW THERE
154B  E5                    PUSH    H
154C  04 9E 11              CALL    NUMB              ;SEE IF THERE IS A NUMB
154F  CD 2A 12              CNC     WHAT              ;IT IS NOT
1552  F5                    CALC    CVB               ;CONVERT NUMBER TO BINA
1553  C5                    PUSH    PSW
1554  CD A3 15              PUSH    B
1557  C1                    CALL    BND2              ;GO FIND FIRST LINE
1558  E5                    POP     B
1559  CD 14 12              DCX     H
155C  04 9E 11              SHLD    PLINE             ;STORE IT WAY AS FIRST
155F  CD 2A 12        BND1:   POP     PSW
1562  F5                    POP     H
1563  C5                    INR     A
1564  CD A3 15              ADD     L                 ;SET UP TO GET UPPER BO
1567  C1                    MOV     L,A
1568  28                    MVI     A,0
1569  22 59 21              ADC     H
156C  F1                    MOV     H,A               ;UPPER BOUND ADDR IN HL
156D  3C                    CMP     C                 ;IS THAT END OF LINE?
156E  85                    RZ
156F  6F                    DCP     C
1570  3E 00                 CALL    NUMB              ;IS NEXT CHAR NUMB?
1572  8C                    CNC     WHAT              ;NOT NUMBER --WHZTS UP
1573  67                    PUSH    D
1574  E5                    CALL    CVB               ;CONVERT TO BINARY
1575  3E 00                 PUSH    D
1577  B9                    PUSH    B
1578  C8                    CALL    BND2              ;GO FIND SECOND BOUND
1579  0D                    POP     B
157A  CD 14 12              INX     H
157D  D4 9E 11              MOV     D,M
1580  05                    INX     H
1581  CD 2A 12              MOV     E,M               ;SETUP TO STORE IT IN K
1584  05                    XCHG
1585  C5                    SHLD    KLINE
1586  CD A3 15              POP     D
                            POP     H
1589  C1                    MOV     A,C
158A  23                    CPI     0                 ;ARE WE AT END OF LINE
158B  56                    JNZ     WHAT
158C  23                    MOV     B,H
158D  5E                    MOV     C,L
158E  EB                    CALL    DCOMP
158F  22 52 21              RNC
1592  D1                    JMP     WHAT
1593  E1              BND2:   LHLD    STLINE            ;SET UP TU SEARCH FROM
1594  79                    MOV     B,M
1595  FE 00                 INX     H
1597  C2 9E 11              MOV     C,H
159A  44                    CALL    DCOMP             ;COMPARE BINARY OF REQU
159B  4D                    RNC                       ;TO CURRENT LINE
159C  CD F1 0F              RZ
159F  DO                    PUSH    H
15A0  C3 9E 11              INX     H
15A3  2A 49 21              MOV     A,M
15A6  46                    INX     H
15A7  23                    MOV     H,M
15A8  4E                    MOV     L,A               ;MOVE TO NEXT LINE
15A9  CD FI 0F              CALL    CHK1              ;IS THAT ALL?
15AC  D8                    POP     B
15AD  C8                    JNC     BNO3              ;NOPE--LOOP ON PROCESS
15AE  E5                    PUSH    B
15AF  23                    MOV     H
15B0  7E                    INX     H
15B1  23                    MOV     A,M
15B2  66                    INX     H
15B3  6F                    MOV     H,M
15B4  CD A3 12              MOV     L,A
15B7  C1                    CALL    CHK1
15B8  D2 A6 15              POP     B
15BB  C5                    JNC     BNO3
15BC  E1                    PUSH    B
15BD  C9                    POP     H
                            RET
```

```
                ;
                ; RDUTINE TO DUTPUT ERROR MSG. TO USER.
                ; REG A CONTAINS BCD ERROR NUMBER, HL
                ; LOADED WITH VALUE OF KLINE.
                ;
15BE  21 13 10  ERROR:  LXI   H,M1A     ;RETURN ADDRESS
15C1  E5        PUSH   H               ;PUT ON STACK
15C2  21 5A 14  LXI    H,+0DATA        ;OUTPUT BUFFER DATA TAB
15C5  E5        PUSH   H
15C6  57        MOV    D,A             ;SAVE ERROR NUMB. IN D
15C7  CD 46 14  CALL   FORM3           ;PAD 'ERROR '
15CA  06 D1     MVI    B,1             ;INIT FOR PAOS
15CC  4B        MOV    C,B             ;INIT AS ENTR.
15CD  7A        MOV    A,D             ;GET ERROR NUMB.
15CE  07        RLC                    ;ROTATE HIGH 4 BITS TO
15CF  07        RLC
15D0  07        RLC
15D1  07        RLC
1502  E6 DF     ERRR1:  ANI   1?4       ;MASK
15D4  C6 B0     ADI    260Q            ;CONVERT TO ASCII
15D6  CD AD 12  CALL   PAD             ;PAD IT
15D9  7A        MOV    A,D             ;GET ERROR NUMB.
15DA  0D        DCR    C               ;ANOTHER PASS?
15DB  F2 D2 15  JP     ERRR1           ;YES
15DE  C1        POP    B               ;NO-CONTINUE
12DF  CD 45 14  ERLN:   CALL   FORM4           ;PAD 'IN LINE'
15E2  2A 52 21  LHLD   KLINE
15E5  23        INX    H
15E6  23        INX    H
15E7  23        INX    H
15E8  23        INX    H
15E9  4E        MOV    C,M
15EA  23        INX    H
15EB  CD 71 12  CALL   LENGTH
15EE  41        MOV    C,A
15EF  CD 4F 14  CALL   FORM6           ;PAD LINE #
15F2  CD D0 12  CALL   WRIT            ;WRITE MESSAGE
15F5  C9        RET
                ;
                ; THIS ROUTINE INCREMENTS H AND L AND
                ; DECR. C(CHARS IN LINE) SHOULD C RESULT
                ; IN 0 THEN THE ERROR CORRES. TO FNTRY PNT.
                ; IS GIVEN
                ;
15F6  3E 07     ICP7:   MVI    A,7
15F8  C3 07 16  JMP    INCPT
15F8  3E 08     ICP8:   MVI    A,8
15FD  C3 07 16  JMP    INCPT
1600  3E 04     ICP4:   MVI    A,4
1602  C3 07 16  JMP    INCPT
1605  3E 02     ICP2:   MVI    A,2
1607  23        INCPT:  INX    H
1608  0D        DCR    C
1609  C0        RNZ
160A  C3 BE 15  JMP    ERROR
                ;
                ; FSYM FINDS SYMBOLS IN TABLE
                ; B,C CONTAIN SYMBOL
                ; RET WITH B,C,D,E SAME
                ; H AND L PNT TO VALUE (1ST BYTE)
                ; CY=1  => FOUND
                ; CY=0  AND A SCALAR VAR. => INSERTED
                ;       AND SET TO 0
                ; CY=0  AND AN ARRAY  => NO ACTION,
                ;       H AND L PNT TO LAST ENTRY IN SYMBOL TABLE
                ;
160D  D5        FSYM:   PUSH   D
160E  AF        XRA    A
160F  B0        ORA    B               ;SET CARRY IF NUT
1610  DA 14 16  JZ     AR              ;AN ARRAY AND SAVE
1613  3F        CMC
1614  F5        AR:     PUSH   PSW             ;GET NEXT AVAILABLE
1615  2A 59 21  LHLD   NXTSP           ;SPACE PNTR.
1618  C5        PUSH   B
1619  44        MOV    B,H             ;CHECK TO SEE
161A  4D        MOV    C,L             ;IF SYMBOL TABLE
161B  2A 4B 21  LHLD   STSPAC          ;EMPTY
161E  54        MOV    D,H
161F  5D        MOV    E,L             ;DOUBLE BYTE COMPARE
1620  CD F1 0F  CALL   DCOMP           ;GET VAR. BACK
1623  C1        POP    B
1624  CA 44 16  JZ     NOSYM
1627  CD A3 12  LUKUN:  CALL   CHKI            ;CHECK FOR END
162A  DA 46 16  JC     NOENT
162D  54        MOV    D,H             ;SAVE DLD PNTR
162E  5D        MOV    E,L
162F  78        MOV    A,B             ;DO VARIABLES MATCH
1630  BE        CMP    M
1631  C2 3A 16  JNZ    NOMAT
1634  23        INX    H
1635  79        MOV    A,C
1636  BE        CMP    M
1637  CA 71 16  JZ     ENTRY
163A  2B        DCX    H
163B  23        NUMAT:  INX    H               ;NO MATCH GET NEW PNT.
163C  23        INX    H
163D  7E        MOV    A,M
163E  23        INX    H
163F  66        MOV    H,M
1640  6F        MOV    L,A
1641  C3 27 16  JMP    LUKUN
                ; ARRIVE HERE IF SYMBOL TABLE IS EMPTY
1644  1B        NOSYM:  DCX    D               ; =STSPAC-2 SO STPNT WO
1645  1B        DCX    D
                ; ARRIVE HERE WHEN NO ENTRY FOUND
1646  2A 59 21  NOENT:  LHLD   NXTSP          ;ADD. OF FREE MEMORY
1649  EB        XCHG                   ;TO DE, HL HAVE LAST SY
164A  F1        POP    PSW             ;ARRAY?
164B  D2 76 16  JNC    FBAC            ;YES, RETURN
164E  CD DB 11  CALL   STPNT           ;UPDATE PNTR
1651  EB        XCHG                   ;NXTSP TO HL
1652  70        MOV    M,B             ;STORE VAR.
1653  23        INX    H
1654  71        MOV    M,C
1655  23        INX    H
1656  E5        PUSH   H               ;STORE NXTSP+8 IN NXTSP
1657  23        INX    H
1658  23        INX    H
1659  23        INX    H
165A  23        INX    H
165B  23        INX    H
165C  23        INX    H
165D  22 59 21  SHLD   NXTSP
1660  CD 14 15  CALL   MEMFUL          ;MEMORY FULL?
1663  F1        POP    H               ;SET FWD PNT. TO -1
1664  36 FF     MVI    M,377Q
1666  23        INX    H
1667  36 FF     MVI    M,377Q
1669  23        INX    H               ;INIT TO FLT. PNT. 0
166A  CD CD 0F  CALL   ZROL
166D  B7        ORA    A               ;CLEAR CY
166E  C3 76 16  JMP    FBAC            ;RESET CARRY AND RETURN
1671  F1        ENTRY:  POP    PSW             ;VAR FOUND
1672  23        INX    H               ;MOVE PNT. TO FIRST BYT
1673  23        INX    H               ;OF FLT. PNT. NO.
1674  23        INX    H
1675  37        STC                    ;SET CY AND RET.
1676  D1        FBAC:   POP    D               ;RESTORE D
1677  C9        RET
                ;
                ;
                ; RUN - THE INTERP.
                ;
                ;
                ; INIT. NXTSP
                ;
1678  2A 4B 21  RUN:    LHLD   STSPAC
167B  22 59 21  SHLD   NXTSP
167E  21 AA 21  LXI    H,BOTNS         ;INIT SP FOR NESTING ST
1681  22 94 21  SHLD   NEST
1684  21 13 10  LXI    H,M1A           ;PRECAUTION, IN CASE RE
1687  E5        PUSH   H               ;EXECUTED BEFORE A GOSU
1688  E5        PUSH   H
1689  2A 49 21  LHLD   STLINE          ;START OF SOURCE
168C  CD 0B 12  ILOOP:  CALL   QUITT           ;CHECK FOR INTERRUPTION
168F  CD A3 12  CALL   CHKI            ;HL=-1 => NO MORE SOURC
1692  D2 9A 16  JNC    SORCE
1695  3E D1     MVI    A,1
1697  C3 BE 15  JMP    ERROR           ;ERROR 1, NO END STMT.
169A  22 52 21  SDRCE:  SHLD   LPNT            ;DEFINE VALUES OF
169D  E5        PUSH   H               ;KFPNT,KLEN
169E  21 52 21  LXI    H,LPVT          ;CHAR'S IN LINE TO C
16A1  CD EE 0F  CALL   PTVAL
16A4  3A 5B 21  LDA    KLEN
16A7  4F        MOV    C,A
16A8  0C        INR    C
16A9  E1        POP    H               ;MOVE PNTR. TO 1ST CHAR
16AA  23        INX    H               ;IN SOURCE REC.
16AB  23        INX    H
16AC  23        INX    H
16AD  23        INX    H
16AE  CD D5 16  L1:     CALL   ICP2            ;INCR. M,L OCR C
16B1  CD 22 12  CALL   ALPHA           ;FIND FIRST LETTER
16B4  D2 AE 16  JNC    L1
16B7  AF        XRA    A
16B8  3C        INR    A               ;LETTER FOUND
16B9  CD F7 12  CALL   SYMSKT          ;DETERMINE KEYWORD
16BC  FE FF     CPI    377Q
16BE  C2 C6 16  JNZ    GKEY
16C1  3E D2     MVI    A,2             ;BAD KEYWORD
16C3  C3 BE 15  JMP    ERROR
16C6  22 5B 21  GKEY:   SHLD   CPNT            ;LOAD JUMP TABLE PNTR.
16C9  21 D6 16  LXI    H,JTBL          ;DOUBLE A
16CC  87        ADD    A
16CD  5F        MOV    E,A
16CE  16 00     MVI    D,0
16D0  19        DAD    D               ;ADD. IN JUMP TABLE
16D1  7E        MOV    A,M             ;GET PROC. ADD.
16D2  23        INX    H
16D3  66        MOV    H,M
16D4  6F        MOV    L,A
16D5  E9        PCHL                   ;INDIRECT JUMP TO PROC.
16D6  DD 1B     JT8L:   DW     LET             ;JMP TABLE
16D8  95 1A     DW     PRI
16DA  8C 1B     DW     IEND            ;REM STMT. - NO ACTION
16DC  13 1D     DW     MIA             ;STOP STMT.-RETURN TO E
16DE  F2 19     DW     ENDD
16E0  00 17     DW     GDTO
16E2  7D 1C     DW     IFRT
16E4  4C 1B     DW     INPUT
16E6  20 17     DW     DIM
16E8  5A 1D     DW     CALLP
16EA  DC 1D     DW     GOSUB
16EC  1D 1D     DW     RETRN
16EE  E7 10     DW     FOR
16F0  D9 1E     DW     NEXT
                ;
                ; END PROCESSOR
                ;
16F2  2A 56 21  ENDD:   LHLD   KFPNT           ;CHECK TO SEE IF MORE
16F5  CD A3 12  CALL   CHKI            ;SOURCE AFTER END
16F8  DA 13 10  JC     MIA
16FB  3E 03     MVI    A,3             ;MORE SOURCE ERROR 3
16FD  C3 BE 15  JMP    ERROR
                ;
                ; GO TO PROCESSOR
                ;
1700  2A 58 21  GDTC:   LHLD   CPNT            ;GOTO STMT. PROC.
1703  23        GSENT:  INX    H               ;INCREMENT PAST KEYWORD
1704  23        INX    H
1705  23        INX    H
1706  CD 00 16  CALL   ICP4            ;POSSIBLE ERROR 4
1709  CD 2A 12  GTRA:   CALL   CVB             ;GET DESTINATION
170C  B7        ORA    A               ;MAKE SURE IT WAS OK
170D  C2 15 17  JNZ    OKN
1710  3E 04     MVI    A,4
1712  C3 BE 15  JMP    ERROR
1715  CD DB 12  OKN:    CALL   NSRCH            ;GET NEXT LPNT
1718  D2 BE 16  JNC    ILOOP           ;MAKE SURE IT EXISTED
171B  3E 05     MVI    A,5
171D  C3 BE 15  JMP    ERROR           ;NON-EXISTENT
                ;
                ; DIMENSION PROCESSOR
                ;
1720  2A 58 21  DIM:    LHLD   CPNT            ;DIM STMT. PROC.
1723  23        INX    H               ;PNT TO FIRST VAR.
1724  23        INX    H
1725  23        INX    H
1726  CD 22 12  DLOOP:  CALL   ALPHA           ;CHECK IF IT IS A VAR.
1729  DA 31 17  JC     OKLET
172C  3E 06     ER6:    MVI    A,6             ;ERROR 6
172E  C3 BE 15  JMP    ERROR
1731  46        OKLFT:  MOV    B,M
1732  CD F6 15  CALL   ICP7            ;INCR. CPNT
1735  3E A8     MVI    A,250Q          ;CHECK FOR (
1737  BE        CMP    M
1738  C2 2C 17  JNZ    ER6
173B  CD F6 15  CALL   ICP7            ;INCR. CPNT
173E  CD 2A 12  CALL   CVB             ;CONV. TO BIN NO.
1741  85        ADD    L               ;UPDATE CPNT
1742  6F        MOV    L,A             ;ED CONTAIN ARRAY LEN.
1743  3E 00     MVI    A,0
1745  8C        ADC    H               ;C CONT. NO. CHARS LEFT
1746  67        MOV    H,A             ;IN LINE
1747  3E A9     MVI    A,251Q          ;CHECK FOR )
1749  BE        CMP    M
174A  C2 2C 17  JNZ    ER6
174D  C5        PUSH   B               ;SAVE B,C,H,L
174E  E5        PUSH   H               ;SET UP FOR CALL TO FSY
174F  48        MOV    C,B
1750  06 00     MVI    B,0
1752  CD 0D 16  CALL   FSYM
1755  D2 5F 17  JNC    NDDU
1758  C1        POP    B
1759  E1        POP    H
175A  3E 11     MVI    A,11H           ;ERROR 11
175C  C3 BE 15  JMP    ERROR           ;DUPLICATE ARRAY DEF.
175F  D5        NODU:   PUSH   D               ;SAVE DIM. LENGTH
1760  E8        XCHG                   ;ADD. OF LAST SYM. TAB.
1761  2A 59 21  LHLD   NXTSP          ;GET ADD. OF AVAILABLE
1764  EB        XCHG                   ;SET UP FOR CALL
1765  CD BB 11  CALL   STPNT           ;STORE NEW PNTR
1768  E8        XCHG                   ;NXTSP TO HL
1769  D1        POP    D               ;RESTORE D
176A  36 00     MVI    M,0             ;INSERT VAR IN SYMB. TA
176C  23        INX    H
176D  71        MOV    M,C
176E  23        INX    H
176F  36 FF     MVI    M,377Q          ;FPNT TO -1
1771  23        INX    H
1772  36 FF     MVI    M,377Q
1774  23        INX    H               ;PNTS TO FIRST DATA
1775  7A        MOV    A,D             ;GET ONES COMPLEMENT O
1776  2F        CMA                    ;NUMBER OF ELEMENTS
1777  4F        MOV    C,A             ;IN ARRAY TO B,C
1778  7B        MOV    A,E
1779  2F        CMA
177A  47        MOV    B,A
177B  CD CD 0F  CONT:   CALL   ZROL            ;ZERO OUT ELEMTS.
177E  23        INX    H               ; OF ARRAY
177F  23        INX    H
1780  23        INX    H
1781  23        INX    H
1782  03        INX    B
1783  F5        PUSH   H
1784  CD 14 15  CALL   MEMFUL          ;MEMORY FULL?
1787  60        MOV    H,B
1788  69        MOV    L,C
1789  CD A3 12  CALL   CHKI
178C  E1        POP    H
178D  D2 7B 17  JNC    CONT
1790  22 59 21  SHLD   NXTSP          ;NEW VALUE OF NXTSP.
1793  C1        POP    B               ;RESTORE REG'S
1794  F1        POP    H
1795  23        INX    H
1796  0D        DCR    C               ;MORE ELEMTS IN LINE?
1797  CA 8C 1B  JZ     IEND
179A  0D        DCR    C
179B  CA 2C 17  JZ     ER6
179E  3E AC     MVI    A,254Q          ;NEXT ELEMENT A ,
17A0  BE        CMP    M
17A1  23        INX    H
17A2  CA 26 17  JZ     DLOOP
17A5  C3 2C 17  JMP    ER6
                ;
                ; ROUTINE TO COPY CONTENTS PNTED TO
                ; BY DE TO LOCATION H,L
                ;
17A8  F5        COPDH:  PUSH   PSW             ;SAVE REGISTERS
17A9  C5        PUSH   B
17AA  D5        PUSH   D
17AB  E5        PUSH   H
17AC  06 04     MVI    B,4             ;COUNT
17AE  1A        COPD1:  LDAX   D               ;GET FROM SOURCE
17AF  77        MOV    M,A             ;PUT TO DESTINATION
17B0  13        INX    D               ;BUMP PNTRS, CNT
17B1  23        INX    H
17B2  05        DCR    B
17B3  C2 AE 17  JNZ    COPD1
17B6  E1        POP    H               ;RESTORE REGISTERS
17B7  D1        POP    D
17B8  C1        POP    B
17B9  F1        POP    PSW
17BA  C9        RET
                ;
                ; OUTR PADS OUTPUT FROM CONV. INTO
                ; OUTPUT BUFFER USING ROUTINE PAO
                ; ALL REG'S MAINTAINED
                ;
17BB  C5        OUTR:   PUSH   B               ;SAVE REG B
17BC  06 01     MVI    B,1             ;PAD ONCE
17BE  CD AD 12  CALL   PAD             ;DO IT
17C1  C1        POP    B               ;RESTORE B AND RET.
17C2  C9        RET
                ;
                ; VALUE RETURNS IN D(H),E(L) PNTR.
                ; TO TME VALUE OF A TOKEN
                ; C,H,L ARE UPDATED
                ; A,B ARE DESTROYED
                ;
17C3  CD 60 18  VALUE:  CALL   VAR             ;IS IT A VARIABLE?
17C6  D8        RC                     ;YES - ALL DONE
17C7  3E D3     MVI    A,3             ;NO CHEK IF A FUNC.
17C9  CD F7 12  CALL   SYMSKT
17CC  FE FF     CPI    377Q
17CE  CA 3B 18  JZ     KONT            ;NOT A FUNCTION -
17D1  FE 01     CPI    1               ;WAS IT PUT(--)?
17D3  C2 D9 17  JNZ    GET             ;NO - OK
17D6  C3 78 1C  JMP    ERID            ;ILLEGAL USE OF FUNCTIO
                                       ;OK, IT'S GET(--)
17D9  23        GET:    INX    H               ;UPDATE H,L
17DA  23        INX    H
17DB  23        INX    H
17DC  B7        ORA    A               ;CHECK FOR PREMATURE EO
17DD  CA 22 1A  JZ     ERB
17E0  3E A8     MVI    A,250Q          ;CHEK FOR (
17E2  BE        CMP    M
17E3  C2 22 1A  JNZ    ERB
17E6  CD F6 15  CALL   ICP8            ;BUMP PNTR'S
17E9  CD C7 19  CALL   EVAL            ;GET PORT #
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17E0  E5                  PUSH   H                ;SAVE REG H,L
17EE  21 7C 21            LXI    H,FREG1
                          CALL   COPDH            ;CORY IT
17F1  CD A8 1T            XCHG
17F4  EB                  POP    H                ;RESTORE H,L
17F5  E1                  CALL   FIX              ;FIX IT
17F6  CD 15 19            INX    D
17F9  13                  INX    D                ;GET LOWEST BYTE TO
17FA  13                  LDAX   D                ;REG U
17FB  1A                  MOV    D,A
17FC  57                  MOV    A,C              ;EOL?
17FD  57                  ORA    A
17FE  T9                  JZ     ERB              ;CHECK FOR )
17FF  B7                  MVI    A,251Q
1800  CA 22 1A            CMP    N
1803  3E A9               JNZ    ERB
1805  BE                  INX,   H                ;BUMP PNTR'S
1806  C2 22 1A            DCR    C
1809  C5                  PUSH   H                ;SAVE H,L,B,C
180A  E5                  PUSH   B                ;STORE PHOGRAM SEGNENT
180B  C5                  LXI    B,GREG           ;IN RAM,START AT GREG
180C  01 TT 21            LXI    H,RINST          ;ADD. OF INST'S
1810  21 36 1B            MVI    E,5              ;NONB. OF BYTES
1813  1E 05               MOV    A,M              ;GET BYTE
1815  7E                  STAX   B                ;STORE IN RAM
1816  D2                  INX    H
1817  23                  INX    B
1818  03                  DCR    E                ;BUMP PNTR'S,DCR CNT
1819  1D                  JNZ    V1
181A  C2 15 1B            LXI    H,GPEG+1         ;STURE PORT #
181D  21 T8 21            MOV    M,D              ;IN RAM
1820  72                  JMP    GREG             ;JUK - TRANSFER
1821  C3 TT 21            LXI    H,GRFG+2         ;SET UP FUR FLOAT
1824  21 T9 21            MOV    M,A              ;STORE AWAY INPUT
1827  77                  DCX    H
1828  2B                  XRA    A                ;ZERO OUT HIGHER BYTES
1829  AF                  MOV    M,A              ;BUT CHAR. OOESN'T NATT
182A  T7                  DCX    H
182B  2B                  MOV    A,M
182C  7T                  CALL   DFXL             ;FLOAT IT
182D  CD DC 0F            LXI    D,GREG           ;FIX D,E RESTORE C,H,L
1830  11 TT 21            RET
1833  C1                  POP    B
1834  E1                  POP    H
1835  C9                  RET
1836  DB 00               IN     D                ;RAM INSTRUCTIONS
1838  C3 24 18            JMP    NONE
183B  CD 14 12            CALL   NUMB             ;NUMBER
183E  DA 4T 18            JC     OKK              ;DEC. PNT.?
1841  3E AE               MVI    A,256D
1843  8E                  CMP    N
1844  C2 2C 1A            JNZ    ERB
1847  3E D1               MVI    A,1              ;MDOE=1, IE. INPUT FROM
                          CALL   ROKON            ;READ CONSTANT TO GREG
184C  DA TC 1F            JC     ERB              ;IF ERROR THEN CY=1
184F  11 TT 21            LXI    D,GREG           ;PNTS. TO CONSTANT
1852  C9                  RET

                ;
                ; THIS ROUTINE READS A CONSTANT IN10 GREG FROM ASCII
                ; CHARACTERS POINTED TO BY HL AND C
                ; ENTER WITH A=0 => DATA FROM TTY
                ; ENTER WITH A#1 => DATA FROM SOURCE
                ; RETURN WITH CY=1 => ERRUR IN CONVERSION
                ;
1853  32 85 21     ROKUN:  STA    NODE             ;SAVE NDDE FOR ROUT. IN
1856  22 86 21             SHLD   HLINP            ;SAVE HL FOR ROUT. INP
1859  79                  MOV    A,C
185A  32 84 21            STA    CREG             ;SAVE C FUR ROUT. INP
185D  21 T7 21            LXI    H,GREG           ;WHERE VALUE WILL GO
1860  0E 66               MVI    C,SCR AND 377Q   ;SET UP AND CALL FINPT
1862  CD E8 DF            CALL   FINRT
1865  2A 86 21            LHLD   HLINP            ;RETORE H,L AND C
1868  3A 84 21            LDA    CREG
186B  4F                  MOV    C,A
186C  C9                  RET                     ;DCNE

                ;
                ; VAR DECIDES WHETHER A TOKEN IS
                ; A VARIABLE IF SO CY=1 AND
                ; ADDRESS IS COMPOTED,(SUBSCRIPT IS
                ; EVALUATED ETC.), RETURNS WITH DE PNTING
                ; TO VAR, REFERENCED H,L,C,UROATED
                ; A,B DESTROYED
                ; IF NOT A VARIBLE CY=D
                ; H,L,C ARE LEFT UNTOUCHED
                ;
186D  CO 22 12     VAR:    CALL   ALPHA            ;1ST CHAR A LETTER?
1870  DO                  RNC                     ;NO-NOT VAR.
1871  23                  INX    H                ;BUMP RNTR'S
1872  0D                  DCR    C
1873  C2 7F 1B            JNZ    MORE
1876  C5          SC1:    PUSH   B                ;NORE TO LINE
1877  0E 00               MVI    C,D              ;SAVE 0,EOL
1879  28                  OCX    H                ;SET FOR CALL TO FSYN
187A  46                  MOV    B,N              ;GET SINGLE LETTER
1878  23                  INX    H                ;VAR TO B
187C  C3 81 1B            JMP    SCALR
187F  CD 22 12     MORE:   CALL   ALPHA            ;2ND A LETTER?
1882  D2 94 1B            JNC    SFSG             ;SO VAR SO GOOD
1885  C5                  PUSH   B                ;SAVE C
1886  3E D2               MVI    A,2              ;CHECK FOR DELINITER
1888  CD F7 12            CALL   SYNSRT
188B  C1                  POP    D
188C  3C                  INR    A                ;RESTORE C
188D  C2 76 1B            JNZ    SC1              ;FOUND?
                                                  ;YES
1890  0L          BUPT:   INX    C                ;NUT A VAK.
1891  28                  DCX    H                ;BACK UP PNTR'S
1892  87                  ORA    A                ;CY=D AND RET
1893  C9                  RET
1894  CD 14 1C   SFSG:    CALL   NUMB             ;TEST FUR NUMBER
1897  D2 89 1B            JNC    ARCK             ;MAYBE AN ARRAY
189A  23                  INX    H                ;ITS A SCALAR
189B  0D                  OCP    C                ;BUMP PNTR'S
189C  CA AA 1B            JZ     SLOAD            ;EOL
189F  C5                  PUSH   B                ;SAVE C
18A0  3E D2               MVI    A,2              ;SET UP FOR SYMSRT
18A2  CD F7 12            CALL   SYNSRT           ;TEST FOR LEGAL
18A5  C1                  POP    B                ;GET C BACK
18A6  3C                  INR    A                ;DELLIMTEK FOUND?
18A7  CA 22 1A            JZ     ERB              ;NU, ERRDR
18AA  2B          SLOAD:  DCX    H                ;NUVE BACK.
18AB  C5                  PUSH   B                ;SAVE C
18AC  4E                  MOV    C,M              ;GET VAR. INTO
18AD  2B                  DCX    H                ;B,C FOR FSYM
18AE  46                  MOV    B,N
18AF  23                  INX    H
18B0  23                  INX    H
18B1  EB          SCALR:  XCHG                    ;SAVE H,L IN D,E
18B2  CD DD 16            CALL   FSYN             ;GET PNTR TO VALUE
18B5  EB                  XCHG                    ;RESTORE H,L PNTR TO DE
18B6  C1                  POP    B                ;GET C REG BACK
18B7  37                  STC                     ;SET CY,RET
18B8  C9                  RET
18B9  TE          ARCK:   MOV    A,N              ;ARRAY CHEK, GET CHARAC
18BA  FE A8               CPI    28DQ             ;IS IT (?
18BC  CA CD 18            JZ     ARYES            ;YES,IT'S AN ARRAY
18BF  3E 02               MVI    A,2              ;NO-CHEK FOR LEGAL DELI
18C1  C5                  PUSH   B                ;SAVE C
18C2  CD F7 12            CALL   SYNSRT
18C5  C1                  POP    B                ;RESTORE C
18C6  3C                  INR    A                ;DELIMITER FOUND?
18C7  CA 22 1A            JZ     ERB
18CA  C3 76 1B            JNP    SC1              ;1 CHAR. SCALAR VAR.
18CD  2B          ARYES:  DCX    H                ;YES-WE HAVE ARRAY
18CE  TE                  MOV    A,M              ;GET VAR.
18CF  23                  INX    H
1800  F5                  PUSH   PSW              ;SAVE VAR.
1801  CD F8 15            CALL   ICP8             ;BUMP PNTR'S
1804  CD C7 19            CALL   EVAL             ;EVALUATE SUBSCRIPT
18D7  E5                  PUSH   H                ;SAVE REG H,L
18D8  21 7C 21            LXI    H,FREG1
18DB  CD A8 17            CALL   COPDH            ;COPY IT
18DE  EB                  XCHG
18DF  E1                  POP    H                ;RESTORE H,L
18E0  CD 15 19            CALL   FIX              ;FIX VALUE
18E3  3E A9               MVI    A,251Q           ;CHECK FOR )
18E5  BE                  CMP    N
18E6  C2 22 1A            JNZ    ERB
18E9  23                  INX    H
18EA  0D                  OCR    C                ;BUMP PNTR'S
18EB  13                  INX    D                ;PNT TO LOWER 2 BYTES
18EC  13                  INX    D
18ED  1A                  LDAX   D
18EE  47                  MOV    B,A              ;H-BYTE TO B
18EF  13                  INX    D                ;PNT TO LOW BYTE
18F0  1A                  LDAX   D                ;LOW BYTE TO A
18F1  87                  ORA    A                ;KILL CY
18F2  17                  RAL                     ;START NULT OF OFFSET
18F3  5F                  MOV    E,A              ;BY 4(BYTES/FLTPT #)
18F4  78                  MUV    A,B              ;GET H BYTE
18F5  17                  RAL
18F6  57                  MOV    D,A              ;DE IS OFFSET*2
18F7  78                  MOV    A,E              ;GET LOW
18F8  87                  DPA    A                ;KILL CARRY
18F9  17                  RAL
18FA  5F                  MOV    E,A
18FB  7A                  MDV    A,D
18FC  17                  RAL
18FD  57                  MOV    D,A
18FE  F1                  POP    PSW              ;DE CONTAIN OFFSET*4
18FF  C5                  PUSH   B                ;GET VAR., SAVE C
1900  4F                  MOV    C,A
1901  06 00               MVI    B,0              ;SETUP TO CALL FSYN
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1903  E5                  RUSH   H                ;SAVE H,L
1904  CD 0D 16            CALL   FSYN             ;GET START ADD.
1907  DA DF 19            JC     AFOND
190A  3E 1Z               MVI    A,12M            ;ERROR 12
190C  C3 BE 15            JNP    ERROR            ;ARRAY REF. NOT 01M*EO.
190F  19          AFOND:  DAD    D                ;H,L NOW PNT TO START O
1910  EB                  XCHG                    ;ARRAY. ADD OFFSET. EXC
1911  E1                  PDR    H                ;RESTORE PNTR'S AND RET
1912  C1                  POP    B
1913  3T                  STC                     ;SET CY
1914  C9                  RET

                ;
                ; ROUTINE TO FIX FLOATING POINT
                ; NUMBERS. ALL REG'S OUT A ARE
                ; MAINTAINED. DE PNT TO 4 BYTES
                ; OF # TO BE FIXED
                ;
1915  C5          FIX:    PUSH   B
1916  E5                  PUSH   H
1917  D5                  PUSH   U                ;SAVE REG'S
1918  13                  INX    D
1919  13                  INX    D
191A  13                  INX    D                ;PNT TO 4TH BYTE
191B  1A                  LUAX   D
191C  F5                  PUSH   PSW              ;SAVE CHAR. (FOR SIGN)
191D  E6 TF               ANI    177Q
191F  17                  RAL                     ;CHEK IF EXP SIGN IS -
1920  17                  RAL
1921  DA 30 19            JC     N1NSE
1924  1F                  RAR
1925  1F                  RAR                     ;RESTURE CHAR.
1926  FE 1B               CRI    300              ;IS IT TUO BIG?
1928  DA 32 19            JC     GOOD
192B  3E 13               NVI    A,13M            ;ERROR 13
192D  C3 BE 15            JNP    ERROR            ;FIX # TUO BIG
1930  1F          HINSE:  RAR
1931  1F                  RAR
1932  12          GUOD:   STAX   D                ;ABSOLUTE VALUE
1933  1B                  DCX    D
1934  1B                  DCX    D
1935  1B                  DCX    D                ;NOV PNTR BACK
1936  21 7C 21            LXI    H,FREG1
1939  CD A8 1T            CALL   COPDH            ;COPY TO FREG1
193C  21 80 21            LXI    H,FREG2          ;STORE .5*2**24 IN
193F  11 6F 19            LXI    D,FOAT           ;FREG2
1942  CD A8 17            CALL   COPDH            ;COPY IT
1945  21 TC 21            LXI    H,FREG1          ;SET UP TO CALL LAOD
1948  06 8D               NVI    B,FREG2 AND 37TQ
194A  0E 66               NVI    C,SCR AND 37TQ
194C  CD D0 DF            CALL   LADD             ;ADO THEN,RESULT IN FRE
194F  21 7C 21            LXI    H,FREG1
1952  F1                  RDP    PSW              ;GET SIGN AND ADO.
1953  01                  POP    O
1954  1T                  RAL
1955  3E D0               NVI    A,D              ;GET SIGN ONLY
1957  1F                  RAR
1958  46                  NOV    B,M              ;GET BYTE1
1959  12                  STAX   D                ;STORE BYTE 1 UF FIX
195A  78                  NOV    A,B
195B  E6 TF               ANI    177Q             ;CLEAR HIGH BIT (FRON A
1950  13                  INX    O
195E  23                  INX    H
195F  46                  MOV    B,N              ;GET BYTE 2
1960  12                  STAX   D                ;STORE BYTE 2 OF FIX
1961  13                  INX    D
1962  T8                  MOV    A,B
1963  23                  INX    H
1964  46                  MOV    B,M              ;GET BYTE 3
1965  12                  STAX   D                ;STORE BYTE 3 OF FIX
1966  78                  NUV    A,B
1967  13                  INX    O
1968  12                  STAX   D                ;STURE BYTE 4 OF FIX
1969  1B                  DCX    D                ;FIX O RNTR
196A  1B                  DCX    D
196B  1B                  DCX    O
196C  E1                  POP    H
196D  C1                  POP    D
196E  C9                  RET
196F  80 00 00 18 FDAT:   DB     2D0Q,0,0,3DQ

                ;
                ; INP SAVES ALL REG'S
                ; SERVES AS BUFFER ROUTINE BETWEEN FINPT AND
                ; DATA INPUT. IF MODE=0, DATA COMES FROM TTY
                ; IF MODE=1 DATA COMES FROM SOURCE STNTS.
                ; IN ALL CASES HL,C ARE UPDATED FROM HLINP, AND
                ; CPEG AND RETURNED TO THOSE LOCATIONS
                ;
1973  E5          INP:    PUSH   H                ;SAVE ALL REG'S
1974  D5                  PUSH   D
1975  C5                  PUSH   B
1976  2A 86 21            LHLD   HLINP            ;GET PNTR'S
1979  3A 84 21            LDA    CREG
197C  4F                  NOV    C,A
197D  B7                  DRA    A                ;CHECK FOR ECL
197E  C2 87 19            JNZ    CHKND            ;NU CHECK MDDE
1981  3E A0         SPACE:  NVI    A,240Q           ;SEND A SPACE
1983  C1          IDONE:  POP    B                ;RESTORE REG'S
1984  D1                  POP    D
1985  E1                  POP    H
1986  C9                  RET                     ;AND RETURN
1987  3A B5 21    CHKMD:  LDA    NODE             ;GET MUDE
198A  3D                  DCR    A                ;CHECK IT
198B  CA 97 19            JZ     NODE1            ;NODE IS 1
198E  7E                  MOV    A,M              ;MODE 0, GET CHAR.
198F  FE AC               CPI    *,* OR 2DDQ      ;IS IT A ',*?
1991  CA B8 19            JZ     SPACE            ;YES - SEND A SPACE
1994  C3 B8 19            JNP    SPACE            ;NO - SEND IT
1997  CD 14 1Z   NODE1:   CALL   NUNB             ;NUMBER? (ALSU LOADS IT
199A  DA B8 19            JC     BNPTR            ;YES - SEND IT AND BUNP
199D  FE AE               CPI    2550             ;DEC. PNT.?
199F  CA B8 19            JZ     BNPTR
19A2  FE C5               CPI    3D5Q             ;E?
19A4  CA B8 19            JZ     BMPTR
19A7  FE A6               CPI    253Q             ;+?
19A9  CA B1 19            JZ     CHEKE
19AC  FE AD               CPI    255Q             ;-?
19AE  C2 B1 19            JNZ    SPACE            ;SEND A SPACE
19B1  47          CHEKE:  NOV    B,A              ;CHEK IF E PRECEDES +,-
19B2  2B                  DCX    H                ;BACK UP AND GET PRE-
19B3  7E                  MUV    A,M              ;CEDING CHARACTER
19B4  FE C5               CPI    3D5Q             ;IS IT E?
19B6  C2 B1 19            JNZ    SPACE            ;NU,UR. WAS DELINITTER
19B9  T8                  NOV    A,B              ;YES,GET + OR -
19BA  23          BNPTP:  INX    H                ;RESTORE H,L
19BB  00                  OCR    C                ;BUMP AND STORE PNTR'S
19BC  22 86 21            SHLD   HLINP
19CO  21 84 21            LXI    H,CRFG
19C3  71                  NJ     N,C
19C4  C3 83 19            JNP    IDONE            ;RESTORE REG'S AND RETJ

                ;
                ; THIS ROUTINE WILL EVALUATE UNARY AND/OR
                ; BINARY EXPRESIONS CALLED WITH H AND L
                ; POINTING TO FIRST CHAR. OF EXP.,C CONTAINS
                ; NUMBER OF CHAR'S LEFT IN LINE. RETUPNS
                ; DE(HIGH) AND E(LOW) POINTING TU THE ANSWER
                ; THIS ROUTINE CALLS ITSELF RECURSIVELY
                ; IN ORDER TO EVALUATE SUBSCRIPT
                ; EXPRESIONS. REG A,B DESTROYED
                ; C,H,L ARE UPDATED
                ;
19C7  3E A0         EVAL:   NVI    A,255Q           ;IS IT UNARY -
19C9  BE                  CNP    M                ;Z=1 => YES
19CA  F5                  PUSH   PSW              ;Z=0 => NO
19CB  C2 01 19            JNZ    ECAV
19CE  CD F8 15            CALL   ICP8             ;BUMP POINTER
19D1  CD C3 17            CALL   VALUE            ;GET PNTR TO VALUE
19D4  E5                  PUSH   H                ;GET VALUE TO FREG1
19D5  21 7C 21            LXI    H,FREG1
19D8  CD A8 17            CALL   COPDH
19DB  EB                  XCHG
19DC  E1                  POP    H
19DD  F1                  POP    PSW              ;GET SIGN
19DE  C2 EC 19            JNZ    DOL              ;SHALL WE NEGATE?
19E1  13                  INX    O                ;YES, POINT TU CHAR.
19E2  13                  INX    O
19E3  13                  INX    O
19F4  1A                  LOAX   D                ;AND LDAQ TO A
19E5  17                  RAL                     ;ROTATE SIGN TO CY
19E6  3F                  CNC                     ;COMPLEMENT IT
19E7  1F                  RAL                     ;ROTATE BACK
19E8  12                  STAX   D                ;STORE AWAY
19E9  18                  OCX    O                ;AND FIX PNTR.
19EA  1B                  DCX    O
19EB  1B                  DCX    O
19EC  79          DOL:    NOV    A,C              ;IS THIS ENO OF LINE?
19ED  87                  ORA    A
19EE  C8                  RZ                      ;YES-RETURN
19EF  C5                  PUSH   B                ;SAVE C
19FO  3E D2               NVI    A,2              ;NO SET UP TO CALL
19F2  CD F7 12            CALL   SYMSRT           ;SYNSRT AND CALL
19F5  C1                  POP    B                ;RESTORE C
19F6  3C                  INR    A                ;DELINITEP FUUNO?
19F7  CA 22 1A            JZ     ERB              ;NO, ERROR
19FA  D6 0A               SUI    10               ;CHECK FOR EXPRESSION
19FC  D8                  RC                      ;DELINITER
19FD  F5                  PUSH   PSW              ;SAVE OVERATION
19FE  CJ F8 15            CALL   ICP8             ;BUMP PNTR'S
1A01  B7                  ORA    A                ;CLEAR CY
1A02  E5          AGA:    PUSH   H                ;GET BYTES OF NUNBER
```

```
1A03  1A                    LDAX   D                ;AND PLACE ON STACK
1A04  6F                    MOV    L,A
1A05  13                    INX    D
1A06  1A                    LDAX   D
1A07  13                    INX    D
1A08  67                    MOV    H,A              ;2 BYTES TO H,L
1A09  E3                    XTHL                    ;XCHANGE, RESTORES H,L
1A0A  3F                    CMC
1A0B  DA 02 1A              JC     AGA              ;ANOTHER PASS?
1A0E  CD C3 1T              CALL   VALUE            ;GET 2ND VALUE
1A0F  79                    MOV    A,C              ;CHECK FOR END OF LINE
1A11  B7                    ORA    A                ;IF SO => WELL FORMED
1A12  CA 2T 1A              JZ     WFOR
1A13  C5                    PUSH   B                ;SAVE C
1A14  3E D2                 MVI    A,2              ;ELSE CALL SYMSRT TO
1A16  CD FT 12              CALL   SYMSRT           ;CHEK FOR EXP. DEL.
1A19  CQ                    POP    B                ;RECOVER IT
1A1C  FE 0A                 CPI    10
1A1E  DA 2T 1A              JC     WFOR             ;YES, WELL FORMED
1A22  3E 0B           ERB:  MVI    A,8              ;ILL-FORMED EXP.
1A24  C3 BE 15              JMP    ERROR
1A27  C5              WFOR: PUSH   B                ;SAVE C, AND H,L
1A28  E5                    PUSH   H
1A29  21 B0 21              LXI    H,FREG2          ;COPY 2ND VALUE TO
1A2C  CD AB 1T              CALL   COPDH            ;FREGZ
1A2F  01                    POP    D                ;GET BYTES FROM STACK
1A30  C1                    POP    B
1A31  E1                    POP    H                ;INTO FREG1+2
1A32  22 7E 21              SHLD   FREG1+2
1A35  E1                    PUP    H                ;AND NEXT 2 BYTES
1A36  22 TC 21              SHLD   FREG1            ;FROM STACK TO FREG1
1A39  EB                    XCHG
1A3A  F1                    POP    PSW              ;GET OPERATION

                ;
                ; THIS ROUTINE PERFORMS BINARY OPERATIONS ON OPERANDS IN
                ; B,C,H,L ARE LEFT UNDISTURBED. A IS DESTROYED
                ; D,E PNT TO RESULT
                ; OPERATIONS ARE SPECIFIED BY A REGISTER AS FOLLOWS:
                ;
                ;       A=0   =>        FREG1 * FREG2
                ;       A=1   =>        FREG1 / FREG2
                ;       A=2   =>        FREG1 + FREG2
                ;       A=3   =>        FREG1 - FREG2
                ;
                ; IN CASE OF ARITHMETIC ERROR A MESSAGE IS SENT TO USER.
                ; IF A CONTAINS ILLEGAL OPERATION REQUEST ERRDR IS SENT T
                ; (ERROR 8) AND RUN ITHE INTERPRETER) IS ABORTED.
                ;
1A3B  C5              BINOP: PUSH   B                ;SAVE REG'S
1A3C  E5                     PUSH   H
1A3D  21 TC 21               LXI    H,FREGI          ;SET UP PNTR'S TO
1A40  06 80                  MVI    B,FREG2 AND 37TQ ;FREG'S AND SCR AREA
1A42  0E 66                  MVI    C,SCR AND 3TTQ   ;AND DO OPERATION
1A44  3D                     DCR    A
1A45  FA BT 1A               JM     FMULT            ;0,1=>* OR /
1A48  CA 8D 1A               JZ     DIV              ;2,3=>+ OR -
1A4D  3D                     DCR    A
1A4C  CA 56 IA               JZ     AUDD
1A4F  3D                     DCR    A
1A50  CA B1 1A               JZ     SUBB
1A53  C3 22 1A               JMP    ERB              ;ILLEGAL OPER.
1A56  CD UD 0F        ADDD:  CALL   LADD             ;DO ADDITION
1A59  54              ASDC:  MOV    D,H              ;FIX PNTR'S FOR RET.
1A5A  5D                     MOV    E,L
1A5B  BT              FPERR: ORA    A                ;SET FLAGS
1A5C  CA TE IA               JZ     NFPER            ;NO ERROR
1A5F  D5                     PUSH   D                ;SAVE DE
1A6D  F5                     PUSH   PSW              ;SAVE A
1A61  CU D0 I2               CALL   WRIT             ;DUMP BUFFER
1A64  F1                     POP    PSW              ;GET A BACK
1A65  21 T7 1A               LXI    H,WFPER          ;RETURN ADDRESS
1A68  E5                     PUSH   H                ;SAVE ON STACK
1A69  21 5A 14               LXI    H,ODATA          ;MESSAGE TABLE
1A6C  IT                     RAL                     ;UNDERFLOW?
1A6D  DA 3F 14               JC     FORI2            ;YES
1A7D  1F                     RAL                     ;OVERFLOW?
1A7I  DA 40 14               JC     FURII            ;YFS
1AT4  C3 41 14               JMP    FURI2            ;NO - ITS ZERODIVIDE
1ATT  21 5A 14        WFPER: LXI    H,ODATA          ;MESSAGE TABLE
1ATA  CD DF 15               CALL   ERLN             ;PRINT 'IN LINE --' (US
1A7D  D1                     POP    D                ;RESTURE REG'S
1A7E  EI              NFPER: POP    H
1ATF  C1                     POP    B
1A80  C9                     RET
1A81  CD U9 OF        SUBB:  CALL   LSUB             ;DO SUBTRACTION
1A84  C3 59 1A               JMP    ASBC
1A87  CD D3 OF        FMULT: CALL   LMUL             ;UO MULT.
1ABA  C3 90 1A               JMP    MDBC
1A8D  CD D6 OF        DIV:   CALL   LDIV             ;OO DIV.
1A90  54              MDBC:  MOV    D,H              ;AND FIX PNTR'S FOR RET
1A91  59                     MOV    E,C
1A92  C3 5B 1A               JMP    FPERR            ;CHECK FOR ERROR

                ; PRINT PROCESSOR
                ;
1A95  2A 5B 2I        PRI:   LHLD   CPNT
1A98  23                     INX    H                ;INCR. PAST KEYWORD
1A99  23                     INX    H
1A9A  23                     INX    H
1A9B  CD F6 15               CALL   ICP7             ;BUMP PNTRS
1A9E  23                     INX    H
1A9F  0D                     OCP    C
1AA0  06 DO                  MVI    B,0              ;SET CHAR CNT
1AA2  C2 AE IA               JNZ    PLOOP            ;CONTINUE IF MORE
1AA5  04                     INR    B                ;NOTHING MORE, PAD A NU
1AA6  3E DO                  MVI    A,O
1AA8  CD AD I2               CALL   PAD
1AAB  C3 46 IB               JMP    PEND             ;WRITE IT ANU CONTINUE
1AAE  TE              PLOOP: MOV    A,M              ;GET CHARACTER
1AAF  FE A2                  CPI    '"'+2DOQ         ;IS IT "?
1AB1  C2 D6 IA               JNZ    EXPRC            ;NO
1AB4  CD F6 15        QUOTE: CALL   ICP7             ;GET CHARACTER TU A
1AB7  TE                     MOV    A,M
1AB8  FE A2                  CPI    '"'+200Q         ;IS IT "?
1ABA  CA CB 1A               JZ     QCHEK
1ABD  04              QOTOK: INR    B                ;INCREMENT CNT
1ABE  5D                     MOV    D,B              ;SAVE IN D
1ABF  06 DI                  MVI    B,1              ;PAD ONCE
1AC1  CD AD I2               CALL   PAD
1AC4  42                     MOV    B,U              ;RESTURE CNT
1AC5  C3 B4 1A               JMP    UUUTP            ;AGAIN
1AC8  23              QCHEK: INX    H                ;BUMP PNTRS
1AC9  0D                     DCR    C
1ACA  CA 46 1B               JZ     PENU             ;EOL
1ACD  TE                     MOV    A,M
1ACE  FE A2                  CPI    '"'+200Q         ;ANUTHER "?
1AD0  CA BD 1A               JZ     QOTOK
1AD3  C3 0T 1B               JMP    SCOLN
1AD6  CD 22 I2        EXPRE: CALL   ALPHA            ;IS IT A LETTER
1AD9  DA ED 1A               JC     PRTIT            ;YES, EVALUATE AND PRIN
1ADC  CD 14 12               CALL   NUMB             ;IS IT A NUMB?
1ADF  DA ED 1A               JC     PRTIT            ;YES, EVALUATE ANU PRIN
1AE2  FE AE                  CPI    '.'+20DQ         ;IS IT A DECIMAL PNT?
1AE5  CA ED 1A               JZ     PRTIT            ;YES EVALUATE, PRINT
1AE8  FE 3D                  CPI    '-'+200Q         ;IS IT A -?
1AEA  C2 07 1B               JNZ    SCOLN            ;NO, CHECK FOR ;
1AED  C5              PRTIT: PUSH   B                ;SAVE CNT
1AEE  CD CT 19               CALL   EVAL             ;EVALUATE EXPRESION
1AF1  C1                     POP    B                ;SAVE C,H,L
1AF2  E5                     PUSH   H
1AF3  EB                     XCHG                    ;DE TO HL
1AF4  0E 66                  MVI    C,SCR AND 3TTQ   ;SET UP, CONVERT
1AF6  CD E5 OF               CALL   CONV
1AF9  E1                     POP    H                ;RESTORE REG'S
1AFA  C1                     POP    B
1AFB  T9                     MOV    A,C
1AFC  C1                     PUP    B
1AFD  4F                     MOV    C,A
1AFE  B7                     ORA    A                ;CHECK EOL
1AFF  CA 46 1B               JZ     PENU
1B02  3E DB                  MVI    A,11             ;UPDATE CNTR
1B04  BQ                     ADD    B
1B05  47                     MOV    B,A
1B06  7E              SCOLN: MOV    A,M              ;GET CHAR.
1B07  FE BB                  CPI    ';'+2DQQ         ;IS IT ;?
1B09  CA 39 1B               JZ     SDNWD            ;YES
1B0C  FE AC                  CPI    ','+200Q         ;IS IT ,?
1B0E  C2 2C 17               JNZ    ER6              ;ND-UNEXPECTED CHAR.
1B11  AF                     XRA    A                ;ZERU A
1B12  C6 DD           ADFLO: ADI    13               ;ADD FIELD LENGTH
1B14  BB                     CMP    B                ;COMPARE TO CNT
1B15  CA 1B 1B               JZ     $+6
1B18  02 2D 1B               JNC    FLOFD
1B1B  FE 34                  CPI    52               ;LAST FLD?
1B1D  C2 12 1B               JNZ    ADFLD
1B2D  CD DD 12               CALL   WRIT             ;YES-WRITE LINE
1B23  D6 00                  MVI    B,0              ;RESET CNT
1B25  23              ONWD:  INX    H                ;BUMP PNTRS
1B26  0D                     DCR    C
1B27  CA 46 1B               JZ     PENO
1B2A  C3 AE 1A               JMP    PLOOP
1B2D  90              FLOFD: SUB    B                ;FUUNU FIELD
1B2E  50                     MOV    D,B              ;DETERMIN  OF SPACES T
1B2F  5F                     MOV    E,A              ;SET UP TO CALL PAD
1B3D  47                     MOV    B,A
1B31  3E AD                  MVI    A,240Q
1B33  CD AD 12               CALL   PAD              ;PAD SPACES
1B36  7A                     MOV    A,D
1B37  83                     ADD    E                ;NEW CNT
1B3B  47                     MOV    B,A              ;SAVE IN B
1B39  23              SONWD: INX    H                ;CHECK EOL
1B3A  DD                     DCR    C
1B3B  C2 AE 1A               JNZ    PLOOP
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1B3E  16 D1                  MVI    D,1              ;SUPPRESS CR/LF
1B40  CD D2 12               CALL   WRIT1
1B43  C3 49 1B               JMP    $+6
1B46  CD DD 12        PEND:  CALL   WRIT             ;DUMP BUFFER, CONTINUE
1B49  C3 BC IB               JMP    IENO

                ; INPUT PROCESSOR - READS VALUES FROM TTY
                ; THEY MUST BE DELIMITED BY COMMAS ONLY
                ;
1B4C  T9              INPUT: MOV    A,C              ;IN CASE OF ERROR
1B4D  32 5F 21               STA    PLC              ;SAVE
1B50  2A 5B 21        INPER: LHLD   CPNT             ;INPUT LINE IV-STRING)
1B53  23                     INX    H                ;ADJUST PNTR'S
1B54  23                     INX    H
1B55  23                     INX    H
1B56  CD F6 15               CALL   ICP7
1B59  CD F6 15               CALL   ICP7
1B5C  C5              PRMPT: PUSH   B                ;SAVE PNTR'S
1B5D  E5                     PUSH   H
1B5F  06 01                  MVI    B,1               ;SEND PROMPT
1B61  3E 3A                  MVI    A,':'
1B63  50                     MOV    D,B               ;TO SUPPRESS CR/LF
1B64  CD AD I2               CALL   PAD               ;PAD IT
1B67  CD D2 12               CALL   WRITI             ;WRITE IT
1B6A  21 B1 21               LXI    H,LBUF            ;ADDR. OF INPUT BUFFER
1B6D  CD C9 13               CALL   TTYIN             ;READ A LINE
1B6F  EB                     XCHG                     ;ADDR. OF K-STRING TO DE
1B7O  E1                     POP    H                 ;ADDR. OF V-STRING
1B71  C1                     PUP    B                 ;V-STRING CNT TO C
1B72  47                     MOV    B,A               ;K-STRING CNT TO B
1B73  CD 92 1B               CALL   STRIN             ;TRANSFER CONSTANTS TU
1B76  CA 89 1B               JZ     INPOK             ;ND ERROR
1B79  21 5A 14               LXI    H,ODDATA          ;SEND ERROR MESSAGE
1B7C  CD 42 14               CALL   FORM9
1B7F  CD DD 12               CALL   WRIT
1B82  3A 5F 21               LDA    PLC               ;GET V-STRING CNT
1B85  4F                     MOV    C,A
1B86  C3 5D 1B               JMP    INPER             ;START AGAIN
1B89  DA 5C 1B        INPOK: JC     PRMPT             ;NEED MORE CONSTANTS
1B8C  2A 5D 21        IEND:  LHLD   KFDNT             ;ALL OK - GET NEW PNTR.
1B8F  C3 BC 16               JMP    ILOOP             ;CONTINUE

                ; THIS ROUTINE TRANSFERS THE FLOATING POINT VALUES
                ; OF AN ASCII STRING OF CONSTANTS TO THE LOCATIONS
                ; SPECIFIED BY AN ASCII STRING OF VARIABLES
                ; POINTER AND LINE CNT OF VAR. STRING ARE IN HL,C
                ; POINTER AND LINE CNT OF CONST. STRING ARE IN DE,B
                ; ON RETURN:
                ;
                ;       Z=0 AND CY=0    ALL OK
                ;       Z=0 AND CY=1    NEED MORE CONSTANTS
                ;       Z=1             ERRDR IN CONVERSION
                ;
                ; ALL POINTERS AND LINE CNT'S ARE RETURNED UPDATED
                ;
1B92  79              STRIN: MOV    A,C              ;GET V-STRING CNT
1B93  BT                     DRA    A                ;TEST FOR EOL
1B94  CB                     RZ                      ;DONE, CY=0 => ALL OK
1B95  TE                     MOV    A,M              ;GET CHAR.
1B96  FE AC                  CPI    ','+ OR 200Q     ;IS IT A ,?
1B9B  C2 AO IB               JNZ    STOKV            ;IT'S NOT A ,
1B9B  23                     INX    H                ;COMMA, BUMP PNTR'S
1B9C  0D                     DCR    C
1B9D  CA C8 IB               JZ     ERRET            ;POSSIBLE ERROR IIF EOL
1BAO  TB              STOKV: MOV    A,B              ;GET K-STRING LENGTH
1BA1  B7                     DRA    A                ;TEST FOR EUL
1BA2  3T                     STC                     ;IN CASE IT'S EOL
1BA3  C8                     RZ                      ;RET, CY=1 => NEED MORE
1BA4  1A                     LDAX   D                ;GET CHAR
1BA5  FE AC                  CPI    ','+ OR 200Q     ;TEST FOR ,
1BAT  C2 AF 1B               JNZ    STUKK            ;NUT A , - READY TO GO
1BAA  13                     INX    D                ;BUMP PNTR'S
1BAB  05                     DCR    B
1BAC  CA CB 1B               JZ     ERRET            ;POSSIBLE ERROR IIF EOL
1BAF  C5              STOKK: PUSH   B                ;SAVE K-STRING CNT
1BB0  D5                     PUSH   D                ;SAVE K-STRING PNTR
1BB1  CD 6D 1B               CALL   VAR              ;ADD. TO VARIBLE TO DE
1BB4  EB                     XCHG                    ;VAR. ADD TO H,L
1BB5  22 BA 21               SHLD   VARAD            ;SAVE
1BB8  EI                     POP    H                ;ADDRESS OF K-STRING
1BB9  T9                     MOV    A,C              ;V-STRING CNT TO A
1BBA  C1                     POP    B                ;K-STRING CNT TO B
1BBB  4B                     MOV    C,B              ;K-STRING CNT TO C
1BBC  F5                     PUSH   PSW              ;SAVE V-STRING CNT
1BBD  D5                     PUSH   D                ;SAVE V-STRING ADD.
1BBE  3E 00                  MVI    A,0              ;A=0 => DATA FROM TTY
1BC0  CD 93 1B               CALL   PROKUN           ;GET CONSTANT TO GREG
1BC3  D2 CB 1B               JNC    STNER
1BC6  EI                     POP    H                ;EMPTY STACK
1BC7  EI                     POP    H
1BC8  AF              ERRET: XRA    A                ;ERROR
1BC9  3C                     INR    A
1BCA  C9                     RET
1BCB  E5              STNER: PUSH   H                ;SAVE K-STRING PNTR.
1BCC  2A BA 2I               LHLD   VARAD            ;GET VAR. ADD
1BCF  II 7T 21               LXI    D,GREG           ;ADD. TO CONST.
1B02  CD AB IT               CALL   COPDH            ;COPY IT TO VARIABLE LU
1B05  D1                     POP    U                ;K-STING PNTR. TU DE
1BD6  41                     MOV    B,C              ;K-STRING LENGTH TO B
1BOT  E1                     POP    H                ;V-STRING PNTR. TU HL
1BD8  F1                     PUP    PSW              ;V-STRING LENGTH TO C
1BD9  4F                     MOV    C,A
1BDA  C3 92 IB               JMP    STRIN            ;LOOP

                ; LET STMT. PRUCESSOR
                ;
1BDD  2A 5B 21        LET:   LHLD   CPNT             ;GET PNTR.
1BE0  23                     INX    H                ;FIX PNTR.
1BE1  23                     INX    H
1BE2  23                     INX    H
1BE3  T9                     MOV    A,C              ;CHECK FUR EOL
1BE4  BT                     DRA    A
1BE5  C2 ED 1B               JNZ    LDK
1BEB  3E OT           ERT:   MVI    A,7
1BEA  C3 BE 15               JMP    ERROR
1BED  CD 6D 1B        LOK:   CALL   VAR              ;GET ADDRESS TO VAR.
1BF0  DA 32 1C               JC     SAVV             ;IT'S A VARIABLE
1BF3  3E 03                  MVI    A,3              ;NO-CHEK FOR FUNC.
1BF5  CO F7 12               CALL   SYMSRT
1BF8  FE FF                  CPI    377Q             ;DON'T KNOW WHAT IT IS
1BFA  CA 22 1A               JZ     ERB
1BFD  3D                     DCR    A
1BFE  C2 T8 1C               JNZ    ERIO             ;ILLEGAL USE OF FUNC.
1C01  23                     INX    H                ;IT'S PUT,UPDATE H,L
1CQ2  23                     INX    H
1CD3  23                     INX    H
1CO4  T9                     MOV    A,C              ;EUL CHK
1C05  BT                     DRA    A
1CD6  CA 22 1A               JZ     ERB
1C09  TE                     MOV    A,M              ;CHEK FOR I
1CDA  FE AB                  CPI    255Q
1C0C  C2 22 1A               JNZ    ERB
1C0F  CD EB 15               CALL   ICPB             ;BUMP PNTRS
1C12  CD CT 19               CALL   EVAL             ;EVALUATE AND FIX
1C15  E5                     PUSH   H                ;SAVE H,L
1C16  21 TC 21               LXI    H,FREG1
1C19  CD AB IT               CALL   COPDH            ;COPY IT
1C1C  EB                     XCHG
1C1D  E1                     POP    H
1C1E  CD 15 19               CALL   FIX
1C21  13                     INX    D
1C22  13                     INX    D
1C23  13                     INX    D
1C24  1A              LDAX   D                       ;GET LOWEST BYTE
1C25  F5                     PUSH   PSW              ;PORT # IS SAVED
1C26  7E                     MOV    A,M
1C2T  FE A9                  CPI    251Q             ;CHECK FOR )
1C29  C2 22 1A               JNZ    ERB
1C2C  CD EB 15               CALL   ICPB             ;BUMP PNTR'S
1C2F  16 FF                  MVI    D,3TTQ
1C31  5A                     MOV    E,D
1C32  D5              SAVV:  PUSH   D                ;KEEP ADDRESS
1C33  TE                     MOV    A,M              ;CHEK FOR =
1C34  FE BD                  CPI    275Q
1C36  C2 22 1A               JNZ    ERB
1C39  CD EB 15               CALL   ICPB             ;BUMP PNTRS
1C3C  CD C7 19               CALL   EVAL             ;EVALUATE EXPRESSION
1C3F  E1                     POP    H                ;GET ADDRESS
1C4D  CD A3 12               CALL   CHK1
1C43  0A 4C IC               JC     PTFIN            ;IT WAS A PUT
1C46  CD AB IT               CALL   COPDH            ;COPY TO ADDRESS
1C49  C3 BC 1B               JMP    IEND             ;CONTINUE
1C4C  21 TC 21        PTFIN: LXI    H,FREG1          ;COPY VALUE TO FREG1
1C4F  CD AB IT               CALL   COPDH
1C52  EB                     XCHG
1C53  CD 15 19               CALL   FIX              ;FIX THE VALUE
1C56  13                     INX    D
1C57  13                     INX    D
1C58  13                     INX    D
1C59  1A                     LQAX   D
1C5A  4F                     MOV    C,A              ;SAVE IN C
1C5B  21 73 1C               LXI    H,PUUST          ;ADD OF BYTES TO GO TO
1C5E  11 77 21               LXI    D,GREG           ;RAM AT GREG
1C61  06 05                  MVI    B,5              ;BYTE CNT
1C63  7E              PR11:  MOV    A,M              ;STORE PROG. SEG. IN
1C64  12                     STAX   D                ;RAM
1C65  23                     INX    H
1C66  13                     INX    D
1C67  05                     DCR    B
1C68  C2 63 1C               JNZ    PR11
1C6B  CT                     POP    PSW              ;GET PORT #
1C6C  21 78 21               LXI    H,GREG+1         ;STORE
1C6F  77                     MOV    M,A              ;GET DATA OUT TO A
1C7U  79                     MOV    A,C              ;TRANSFER
1C7I  2B                     DCX    H
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1C72  F9                PCHL
1C73  03 00             PINST:  OUT     0               ;RAM INSTRUCTIONS
1C75  C3 BC 1B          ERR0:   JMP     IEND
1C78  3E 1C             ERR1:   MVI     A,1CH
1C7A  C3 BF 15                  JMP     ERROR
                        ;
                        ; IF STMT. PROCESSOR
                        ;
1C7D  2A 56 21          IFRT:   LHLD    CPNT            ;GET PNTR., ADJUST
1C80  23                        INX     H
1C81  0E                        INR     C
1C82  CD F6 15                  CALL    ICP7            ;CHECK EOL
1C85  CD C7 19                  CALL    EVAL            ;EVALUATE EXPRESSION
1C88  79                        MOV     A,C
1C89  B7                        ORA     A               ;CHECK EOL
1C8A  CA E8 18          IAGA:   JZ      ER7
1C8D  E5                        PUSH    H               ;SAVE H,L, PUT VALUE ON
1C8E  1A                        LDAX    D
1C8F  13                        INX     D
1C90  6F                        MOV     L,A
1C91  1A                        LDAX    D
1C92  13                        INX     D
1C93  67                        MOV     H,A
1C94  E3                        XTHL                    ;RESTORE H,L
1C95  3F                        CMC
1C96  DA 8D 1C          ERR14:  JC      IAGA            ;ANOTHER PASS?
1C99  3E 02             III:    MVI     A,2
1C9B  CD F7 12                  CALL    SYMSRT          ;CHEK TYPE OF RELATION
1C9E  FE 04                     CPI     4               ;WAS IT LEGAL?
1CA0  DA A8 1C                  JC      III
1CA3  3E 14                     MVI     A,14H
1CA5  C3 BF 15                  JMP     ERROR
1CA8  FE 02                     CPI     2               ;WAS IT A ,?
1CAA  CA A3 1C                  JZ      ER14
1CAD  3C                        INR     A               ;ALL OK, INC,SAVE
1CAE  F5                        PUSH    PSW
1CAF  0C                        INR     C
1CB0  CD F6 15                  CALL    ICP7            ;BUMP PNTRS
1CB3  3E 02                     MVI     A,2             ;CALL SYMSRT
1CB5  CD F7 12                  CALL    SYMSPT
1CB8  FE FF                     CPI     377Q            ;FOUND ANYTHING?
1CBA  CA D5 1C                  JZ      RELAT           ;DONE
1CBD  FE 02                     CPI     2
1CBF  CA A3 1C                  JZ      ER14            ;IT WAS A ,
1CC2  FE 04                     CPI     4
1CC4  D2 A3 1C                  JNC     ER14            ;NOT LEGAL
1CC7  3C                        INR     A
1CC8  47                        MOV     B,A
1CC9  0C                        INR     C
1CCA  CD F6 15                  CALL    ICP7
1CCD  F1                        POP     PSW             ;GET SECOND RELATION
1CCE  80                        ADD     B               ;ADD THEM
1CCF  F5                        PUSH    PSW             ;AND SAVE
1CD0  FE 08                     CPI     10Q             ;TEST FOR ==
1CD2  CA A3 1C                  JZ      ER14
                        ;
                        ; AT THIS POINT:
                        ; RELATION IS STORED ON TOP OF STACK (PUSH PSW) ACCORDING
                        ; THE FOLLOWING
                        ;
                        ;       1 => <
                        ;       2 => >
                        ;       3 => <>
                        ;       4 => =
                        ;       5 => <=
                        ;       6 => >=
                        ;
1CD5  CD C7 19          RELAT:  CALL    EVAL            ;EVALUATE
1CD8  E5                        PUSH    H               ;SAVE H,L
1CD9  21 B0 21                  LXI     H,FREG2         ;COPY TO FREG2
1CDC  CD A8 17                  CALL    COPDH
1CDF  E1                        POP     H               ;GET H,L
1CE0  F1                        POP     PSW             ;AND RELATION
1CE1  E3                        XTHL                    ;GET 2ND 2 BYTES
1CE2  22 7F 21                  SHLD    FREG1+2         ;STORE
1CE5  E1                        POP     H               ;GET 1ST 2 BYTES,STORE
1CE6  E3                        XTHL
1CE7  22 7C 21                  SHLD    FREG1
1CEA  C5                        PUSH    B
1CEB  F5                        PUSH    PSW             ;SAVE A,B,C
1CEC  CD 2B 1D                  CALL    FCOMP           ;COMPARE NUMBERS
1CEF  57                        MOV     D,A             ;SAVE RESULT IN D
1CF0  F1                        POP     PSW             ;GET RELATION,B,C
1CF1  C1                        POP     B
1CF2  BA                        CMP     D               ;SAME?
1CF3  CA 1C 1D                  JZ      TRUE            ;YES
1CF6  D6 04                     SUI     4
1CF8  F2 08 1D                  JP      NOT3            ;NOT RELATION 3
1CFB  3C                        INR     A               ;IS IT RELATION 3?
1CFC  C2 12 1D                  JNZ     FALSE           ;NO, ITS FALSE
1CFF  3E 04                     MVI     A,4             ;IT IS, CHECK FOR INEQU
1D01  BA                        CMP     D
1D02  C2 16 1D                  JNZ     TRUE
1D05  C3 12 1D                  JMP     FALSE
1D08  BA                NOT3:   CMP     D               ;RELATION 5,6 TRUE?
1D09  CA 16 1D                  JZ      TRUE            ;YES
1D0C  3E 04                     MVI     A,4             ;IT WAS, CHECK FOR EQUA
1D0E  BA                        CMP     D
1D0F  CA 16 1D                  JZ      TRUE
1D12  E1                FALSE:  POP     H               ;CONTINUE
1D13  C3 BC 1B                  JMP     IEND
1D16  E1                TRUE:   POP     H
1D17  06 04                     MVI     B,4
1D19  CD F6 15          THEN:   CALL    ICP7            ;INCREMENT PAST THEN
1D1C  05                        DCR     B
1D1D  C2 19 1D                  JNZ     THEN
1D20  C3 09 17                  JMP     GTRA            ;TRANSFER TO GOTO
                        ; ROUTINE FCOMP COMPARES 2 FLOATING POINT #'S.  THEY ARE
                        ; TO BE IN FREG1 AND FREG2.
                        ; ALL REGISTERS ARE DESTROYED.
                        ; THE VALUE RETURNED IN REG A IS RESULT OF COMPARISON.
                        ; RESULTS ARE AS FOLLOWS:
                        ;
                        ;       A=1     =>      FREG1 < FREG2
                        ;       A=2     =>      FREG1 > FREG2
                        ;       A=4     =>      FREG1 = FREG2
                        ;
1D23  21 7F 21          FCOMP:  LXI     H,FREG1+3       ;PNTS TO CHAR OF 1ST
1D26  11 83 21                  LXI     D,FREG2+3       ;PNTS TO CHAR OF 2ND
1D29  7E                        MOV     A,M             ;GET 1 CHAR
1D2A  06 80                     MVI     B,200Q          ;MASK TO 8
1D2C  A0                        ANA     B               ;GET SIGN, 1
1D2D  4F                        MOV     C,A             ;SAVE IN C
1D2E  1A                        LDAX    D               ;GET CHAR 2
1D2F  A0                        ANA     B               ;GET SIGN 2
1D30  A9                        XRA     C
1D31  CA 38 1D                  JZ      SINEQ           ;SAME SIGNS
1D34  79                        MOV     A,C             ;OPPISITE SIGNS,GET 1
1D35  17                        RAL                     ;ROTATE TO CY
1D36  3E 01                     MVI     A,1
1D38  D8                        RC                      ;FREG1 < FREG2 => A=1
1D39  3C                        INR     A               ;ELSE FREG1 > FREG2
1D3A  C9                        RET                     ;AND A=2
1D3B  C5                SINEQ:  PUSH    B               ;SAVE SIGN
1D3C  26                        DCX     H               ;PNTR TO  1 IN H,L
1D3D  28                        DCX     H
1D3E  2D                        DCX     H
1D3F  43                        MOV     B,E             ;PNTR TO  2 IN B
1D40  05                        DCR     B
1D41  05                        DCR     B
1D42  05                        DCR     B
1D43  CD 0F 0F                  CALL    CMGM            ;COMPARE MAGNITUDES
                        ; AT THIS POINT Z=1 => =, CY=1 => <2
1D46  C1                        POP     B               ;GET SIGN BACK
1D47  C2 4D 1D                  JNZ     $+6
1D4A  3E 04                     MVI     A,4             ;EQUAL => A=4
1D4C  C9                        RET
1D4D  79                        MOV     A,C             ;GET SIGN TO A
1D4E  3C                        INR     A               ;SET SIGN BIT
1D4F  3E 01                     MVI     A,1
1D51  FA 57 1D                  JM      $+6             ;SIGN IS NEGATIVE
1D54  0D                        RC                      ;SIGN=+ AND A<1(FREG1)<
1D55  3C                        INR     A               ;ABS(FREG1)>ABS(FREG2)
1D56  C9                        RET
1D57  00                        RNC                     ;SIGN=- AND ABS(FREG1)>
1D58  3C                        INR     A               ;ABS(FREG1)<ABS(FREG2)
1D59  C9                        RET
                        ; CALL PROCESSOR
1D5A  21 3C 1B          CALLP:  LXI     H,IE4D          ;INIT RETURN ADDRESS
1D5D  E5                        PUSH    H
1D5E  2A 56 21                  LHLD    CPNT            ;INIT POINTERS
1D61  23                        INX     H
1D62  23                        INX     H
1D63  23                        INX     H
1D64  CD F6 15                  CALL    ICP7
1D67  7E                        MOV     A,M
1D68  FE A8                     CPI     '('+200Q        ;GET CHAR
1D6A  C2 8B 1D                  JNZ     ER7             ;IS IT A (?
1D6D  CD F6 15                  CALL    ICP7            ;BAD
1D70  CD 2A 12                  CALL    CV8             ;BUMP PNTRS
1D73  85                        ADD     L               ;GET SUB
1D74  6F                        MOV     L,A             ;UPDATA H,L
1D75  3F 00                     MVI     A,0
1D77  8C                        ADC     H
1D78  67                        MOV     H,A
1D79  E5                        PUSH    H               ;D NOW CONTAINS SUB
1D7A  21 AC 21                  LXI     H,SUBS          ;SAVE HL
1D7D  7E                NUSUB:  MOV     A,M             ;GET START OF SUB TABLE
1D7E  BA                        CMP     D               ;GET ENTRY
1D7F  CA 8C 1D                  JZ      FNDSB           ;COMPARE
1D82  23                        INX     H               ;FOUND IT
1D83  23                        INX     H               ;PNT TO NEXT ENTRY
1D84  23                        INX     H
1D85  3C                        INR     A
1D86  C2 7D 1D                  JNZ     NUSUB           ;CHECK TO SEE IF LAST W
1D89  3E 15                     MVI     A,15H           ;ER 15 - NO SUB BY THIS
1D8B  C3 BF 15                  JMP     ERROR
1D8E  5E                FNDSB:  MOV     E,M             ;FOUND IT,GET STARTING
1D8F  23                        INX     H
1D90  56                        MOV     D,M
1D91  23                        INX     H
1D92  6E                        MOV     L,M             ;AND SAVE IT
1D93  22 50 21                  SHLD    SBSAV
1D96  2A 59 21                  LHLD    NXTSP           ;INIT MEMORY SCRATCH AR
1D99  22 88 21                  SHLD    MESCR
1D9C  E1                        POP     H               ;GET SOURCE PNTR BACK
1D9D  7E                PARLP:  MOV     A,M             ;GET CHAR
1D9E  FE A9                     CPI     ')'+200Q        ;IS IT )?
1DA0  CA CC 1D                  JZ      CLSUB           ;YES - GO CALL SUB
1DA3  FE AC                     CPI     ','+200Q        ;NO WE HAVE A ,?
1DA5  C2 2C 17                  JNZ     ER6             ;UNEXPECTED CHARACTER
1DA8  CD F6 15                  CALL    ICP7            ;BUMP PNTRS
1DAB  CD 6C 18                  CALL    VAR             ;NO WE HAVE A VARIABLE
1DAE  D2 B5 1D                  JNC     PREXP           ;NO
1DB1  D5                        PUSH    D               ;YES - SAVE ADDRESS
1DB2  C3 9D 1D                  JMP     PARLP           ;CONTINUE
1DB5  CD C7 19          PREXP:  CALL    EVAL            ;EVALUATE EXPRESSION
1DB8  E5                        PUSH    H               ;SAVE H,L
1DB9  2A 88 21                  LHLD    MESCP           ;GET SCRATCH AREA
1DBC  CD A6 17                  CALL    COPDH           ;AND COPY TO IT
1DBF  E1                        POP     H               ;HL TO DE
1DC0  E5                        PUSH    H               ;SAVE ADDRESS
1DC1  23                        INX     H               ;UPDATE MLSCR
1DC2  23                        INX     H
1DC3  23                        INX     H
1DC4  23                        INX     H
1DC5  22 88 21                  SHLD    MESCR           ;SAVE IT
1DC8  EB                        XCHG                    ;GET OLD BACK
1DC9  C3 9D 1D                  JMP     PARLP           ;CONTINUE
1DCC  2A 50 21          CLSUB:  LHLD    SBSAV           ;START OF ROUTINE
1DCF  E9                        PCHL                    ;TRANSFER
                        ; GOSUB PROCESSOR
1DD0  21 8C 1C          GOSUB:  LXI     H,ILOOP         ;FOR RETURN STMT.
1DD3  E5                        PUSH    H               ;TO STACK
1DD4  2A 56 21                  LHLD    KFPNT           ;PNTR. TO NEXT STMT.
1DD7  E5                        PUSH    H               ;SAVE ON STACK
1DD8  2A 59 21                  LHLD    NXTSP           ;CHECK MEMORY
1DDB  CD 14 1C                  CALL    MEMFUL
1DDE  2A 56 21                  LHLD    CPNT            ;GET CHAR. PNTR
1DE1  23                        INX     H
1DE2  C3 03 17                  JMP     GSENT           ;PART OF GOTO TO FINISH
                        ; RETURN STMT. PROCESSOR
1DE5  F1                RETRN:  POP     H               ;GET RETURN ADD. FROM S
1DF6  C9                        RET                     ;CONTINUE
                        ; FOR STATEMENT PROCESSOR
1DE7  2A 56 21          FOR:    LHLD    CPNT            ;FIX PNTRS
1DEA  0C                        INR     C
1DEB  23                        INX     H
1DEC  23                        INX     H
1DED  CD F6 15                  CALL    ICP7
1DF0  CD 22 12                  CALL    ALPHA           ;LETTER?
1DF3  D2 9A 1F                  JNC     ER21            ;NO
1DF6  46                        MOV     B,M             ;GET IT TO B
1DF7  CD F6 15                  CALL    ICP7            ;BUMP PNTR'S
1DFA  51                        MOV     D,C             ;SAVE C
1DFB  0E 00                     MVI     C,0             ;INIT TO 0
1DFD  CD 14 12                  CALL    NUMD            ;NUMBER?
1E00  D2 D9 1E                  JNC     $+9             ;NO
1E03  4E                        MOV     C,M             ;YES, GET IT
1E04  23                        INX     H               ;BUMP PNTR'S
1E05  15                        DCR     D
1E06  CA E8 18                  JZ      ER7
1E09  E5                        PUSH    H               ;PREMATURE EOL
1E0A  CD 0D 16                  CALL    FSYM            ;SAVE H,L
1E0D  F3                        XTHL                    ;GET VAR. LOCATION
1E0E  59                        MOV     E,C             ;PUT ON STACK, GET H,L
1E0F  4A                        MOV     C,D             ;VARIABLE TO D,E
1E10  50                        MOV     D,B             ;RESTORE C
1E11  EB                        XCHG
1E12  22 8C 21                  SHLD    VNAME           ;SAVE VAR NAME
1E15  EB                        XCHG
1E16  7E                        MOV     A,M             ;RESTORE H,L
1E17  FE B0                     CPI     '='+200Q        ;LOOK FOR =
1E19  C2 81 1F                  JNZ     ER16
1E1C  CD F6 15                  CALL    ICP7
1E1F  CD C7 19                  CALL    EVAL
1E22  E3                        XTHL                    ;BUMP PNTR'S
1E23  CD A8 17                  CALL    COPDH           ;EVALUATE EXPRESSION
1E26  22 8E 21                  SHLD    VLOC            ;VARIABLE LOCATION
1E29  E1                        POP     H               ;WRITE VALUE
1E2A  79                        MOV     A,C             ;SAVE PNTR TO VARIABLE
1E2B  B7                        ORA     A               ;GET H,L BACK
1E2C  CA E8 18                  JZ      ER7             ;CHECK EOL
1E2F  3E 02                     MVI     A,2
1E31  CD F7 12                  CALL    SYMSRT          ;CHECK FOR 'TO'
1E34  FE 07                     CPI     7
1E36  C2 86 1F                  JNZ     ER17
1E39  23                        INX     H               ;BUMB PNTR'S
1E3A  23                        INX     H
1E3B  79                        MOV     A,C             ;CHECK EOL
1E3C  B7                        ORA     A
1E3D  CA E8 18                  JZ      ER7
1E40  CD C7 19                  CALL    EVAL            ;EVALUATE LIMIT
1E43  E5                        PUSH    H               ;SAVE H,L
1E44  21 90 21                  LXI     H,FLLMT         ;SAVE LIMIT VALUE
1E47  CD A8 17                  CALL    COPDH
1E4A  79                        MOV     A,C             ;CHECK EOL
1E4B  B7                        ORA     A
1E4C  C2 5C 1E                  JNZ     STP
1E4F  11 D5 1E                  LXI     D,FONE          ;DEFAULT STEP=1
1E52  E1                        POP     H               ;RESTORE H,L
1E53  C3 6B 1F                  JMP     FBILD
1E56  E1                STP:    POP     H               ;GET H,L
1E57  3E 02                     MVI     A,2             ;LOOK FOR 'STEP'
1E59  CD F7 12                  CALL    SYMSRT
1E5C  FE 08                     CPI     8
1E5E  C2 86 1F                  JNZ     ER17
1E61  23                        INX     H               ;FIX H,L
1E62  23                        INX     H
1E63  23                        INX     H
1E64  3C                        INR     C
1E65  CD F6 15                  CALL    ICP7            ;CHECK EOL
1E68  CD C7 19                  CALL    EVAL            ;GET STEP SIZE
                        ; AT THIS POINT:
                        ; VARIABLE NAME IS IN LOCATION VNAME
                        ; VARIABLE ADDRESS IS IN LOCATION VLOC
                        ; VARIBLE HAS BEEN INITIALIZED
                        ; LIMIT IS IN 4 BYTE LOCATION FLIMT
                        ; STEP IS POINTED TO BY D,E
                        ; H,L,C ARE POINTER, COUNTER AS USUAL
1E6B  05                FBILD:  PUSH    D               ;SAVE PNTR TO STEP
1E6C  2A 8C 21                  LHLD    VNAME           ;GET VARIABLE NAME
1E6F  3F                        MVI     A,77Q           ;MASK
1E70  A4                        ANA     H               ;MASK OFF TOP 2 BITS
1E71  47                        MOV     B,A             ;SET UP TO CALL FSYM
1E72  4D                        MOV     C,L
1E73  CD 0D 16                  CALL    FSYM            ;FIND ENTRY
1E76  F5                        JC      FEXST           ;IT WAS THERE
1E77  2A 59 21                  PUSH    H               ;IT WASN'T, SAVE H,L
1E7A  3E 08                     LHLD    NXTSP           ;UPDATE NXTSP
1E7C  85                        MVI     A,8             ;ADD 8 TO H,L
1E7D  6F                        ADD     L
1E7E  3E 00                     MOV     L,A
1E80  8C                        MVI     A,0
1E81  67                        ADC     H
1E82  22 59 21                  MOV     H,A
1E85  CD 14 1C                  SHLD    NXTSP           ;NEW VALUE OF NXTSP
1E88  E1                        CALL    MEMFUL          ;CHECK MEMORY
1E89  D1                FEXST:  POP     H               ;GET ADD. IN DATA BLOCK
1E8A  CD A8 17                  POP     D               ;ADDRESS OF STEP SIZE
1E8D  23                        CALL    COPDH           ;STORE IT
1E8E  23                        INX     H               ;PNT TO WHERE VAR. PNTR
1E8F  23                        INX     H
1E90  23                        INX     H
1E91  23                        INX     H
1E92  5A 8E 21                  LDA     VLOC            ;FIRST BYTE
1E95  77                        MOV     M,A             ;STORE IT
1E96  23                        INX     H
1E97  3A 8F 21                  LDA     VLOC+1          ;SECOND BYTE
1E9A  77                        MOV     M,A
1E9B  23                        INX     H               ;PNT TO WHERE LIMIT GOE
1E9C  11 90 21                  LXI     D,FLLMT         ;WHERE IT IS NOW
1E9F  CD A6 17                  CALL    COPDH           ;COPY IT
1EA2  23                        INX     H               ;PNT TO WHERE KFPNT GOE
1EA3  23                        INX     H
1EA4  23                        INX     H
1EA5  23                        INX     H
1EA6  3A 56 21                  LDA     KFPNT           ;1ST BYTE
1EA9  77                        MOV     M,A
1EAA  23                        INX     H
1EAB  3A 57 21                  LDA     KFPNT+1         ;2ND BYTE
1EAE  77                        MOV     M,A
                        ; PUT CURRENT VNAME ON NESTING STACK
1EAF  21 00 00                  LXI     H,0             ;GET STACK-POINTER
1EB2  39                        DAD     SP
1EB3  22 8E 21                  SHLD    VLOC            ;SAVE IT
1EB6  2A 94 21                  LHLD    NEST            ;GET NEST SP
1EB9  7D                        MOV     A,L             ;COMPARE WITH STACK LIM
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1E8D   FE 96              CP1     TOPNS AND 377Q   ;NEED ONLY COMPARE PAGE
1E8F   CA 8B 1F           JZ      FR18             ;FOR'S NEXTED TOO DEEPL
1E92   F9           NSTOK: SPHL                    ;LOAD NEW SP
1E93   E8                 XCHG                     ;SAVE NEST SP
1E94   2A 8C 21           LHLD    VNAME            ;GET INDEX NAME
1E97   E5                 PUSH    H                ;SAVE IT
1E98   18                 DCX     D                ;UPDATE NEST SP
1E99   18                 DCX     D
1E9A   EB                 XCHG
1E9B   22 94 21           SHLD    NEST             ;RESTURE OLD SP
1E9E   2A 8E 21           LHLD    VLOC
1EA1   F9                 SPHL
1EA2   C3 8C 18           JMP     IEND             ;ALL OONE
1EA5   8D 00 00 01 FONE:  DB      20D0.0.0.0010    ;FLOATING PNT ONE
                   ;
                   ; NEXT STATEMENT PROCESSOR
                   ;
1EA9   2A 58 21    NEXT:  LHLD    CPNT             ;FIX PNTR'S
1EAC   23                 INX     H
1EAD   23                 INX     H
1EAE   23                 INX     H
1EAF   0C                 INR     C
1EB0   CD F6 15           CALL    ICP7
1EB3   CD 22 12           CALL    ALPHA            ;LETTER?
1EB6   D2 9A 1F           JNC     ER21             ;NO, ERROR
1EB9   46                 NOV     B,M              ;YES, GET IT
1EBA   51                 MOV     D,C              ;SAVE IT
1EBB   0E 00              MVI     C,0              ;INIT C TO D
1EBD   23                 INX     H                ;BUMP PNTR'S
1EBE   15                 DCR     D
1EBF   CA FD 1E           JZ      NEXTL
1EC2   CD 14 12           CALL    NUMB             ;NUMBER?
1EC5   D2 9A 1F           JNC     ER21             ;NO, ERROR
1EC8   4E                 NOV     C,M              ;YES, GET IT
1EC9   15                 DCR     D                ;SHOULD BE ECL
1ECA   C2 9A 1F           JNZ     ER21
1ECD   21 00 00    NEXT1: LXI     H,0              ;GET SP
1ED0   39                 DAD     SP
1ED1   22 8C 21           SHLD    VLOC             ;SAVE IT
1ED4   2A 94 21           LHLD    NEST             ;GET NEST SP
1ED7   7D                 MOV     A,L              ;COMPARE WITH BOTTON
1ED8   FE AA              CPI     BOTNS AND 377Q
1EDA   CA 90 1F           JZ      ER19             ;NEXT BEFORE FOR
1EDD   F9                 SPHL                     ;LOAD SP
1EDE   E1                 POP     H                ;GET LAST INDEX
1EDF   B8                 CMP     H                ;COMPARE TO CURRENT
1EE0   BC                 CMP     H
1EE1   C2 95 1F           JNZ     ER2D             ;NESTING ERROR
1EE4   79                 MOV     A,C
1EE5   BD                 CMP     L
1EE6   C2 95 1F           JNZ     ER20
1EE9   2A 8E 21           LHLD    VLOC             ;ALL OK, RESTURE OLD SP
1EEC   F9                 SPHL
1EED   3E 3F              NVI     A,77Q            ;MASK
1EEF   AD                 ANA     B                ;MASK OUT TOP 2 BITS
1EF0   47                 NOV     B,A
1EF1   CD DD 16           CALL    FSYN             ;FIND SYNBOL
1EF4   EB                 XCHG                     ;ADDRESS TO D,E
1EF5   21 7C 21           LXI     H,FREG1          ;COPY STEP TO FREG1
1EF8   CD A8 17           CALL    COPDH
1EFB   13                 INX     D                ;PNT TO CHARACTERISTIC
1EFC   13                 INX     D
1EFD   13                 INX     D
1EFE   1A                 LDAX    D                ;GET IT
1EFF   E6 80              ANI     2D00             ;GET SIGN
1F01   17                 RAL                      ;ROTATE IT INTO CARRY
1F02   3F                 CMC                      ;COMPLEMENT IT
1F03   3E 00              MVI     A,0              ;MAKE SURE A=0
1F05   1F                 RAR                      ;ROTATE TO LSB
1F06   3C                 INR     A                ;BUMP BY ONE
1F07   32 BL 21           STA     VLOC             ;SAVE IT, ITS =1 IF.= S
1F0A   13                 INX     D                ;PNT TO VARIABLE PNTR
1F0B   EB                 XCHG                     ;GET IT TO DE
1F0C   5E                 MOV     E,M
1F0D   23                 INX     H
1F0E   56                 MOV     D,M              ;SAVE DATA BLOCK PNTR.
1F0F   23                 INX     H
1F10   E5                 PUSH    H
1F11   21 80 21           LXI     H,FREG2          ;COPY VARIBLE VALUE TO
1F14   CD A8 17           CALL    COPDH            ;SAVE VARIABLE LOCATION
1F17   EB                 XCHG
1F18   3E 02              MVI     A,2              ;SET UP TO ADD
1F1A   CD 3B 1A           CALL    BINOP            ;AND DO IT
1F1D   CD A8 17           CALL    COPDH            ;COPY TO VARIABLE
1F20   21 7C 21           LXI     H,FREG1          ;AND TO FREG1 FOR COMPA
1F23   CD A8 17           CALL    COPDH
1F26   D1                 POP     D                ;PNT TO LIMIT
1F27   21 80 21           LXI     H,FREG2          ;COPY TO FREG2
1F2A   CD A8 17           CALL    COPDH
1F2D   D5                 PUSH    D                ;SAVE DATA BLOCK PNTR
1F2E   CD 23 1D           CALL    FCOMP            ;COMPARE
1F31   21 8E 21           LXI     H,VLOC           ;COMPARE WITH STEP TYPE
1F34   BE                 CMP     M
1F35   F1                 POP     H                ;GET DATA BLOCK PNTR.
1F36   CA 74 1F           JZ      NXTON            ;YES => LOOP DONE
1F39   23                 INX     H                ;LOOP NOT DONE
1F3A   23                 INX     H                ;PNT TO TRANSFER ADD.
1F3B   23                 INX     H
1F3C   23                 INX     H
1F3D   5E                 MOV     E,M              ;GET IT TO N,L
1F3E   23                 INX     H
1F3F   56                 MOV     D,M
1F40   EB                 XCHG
1F41   C3 BC 16           JNP     ILOOP
1F44   21 94 21    NXTON: LXI     H,NEST           ;POP NEST STACK
1F47   34                 INR     M
1F48   34                 INR     M
1F49   C3 8C 18           JNP     IEND             ;CONTINUE
1F4C   3E 09       EP9:   MVI     A,9
1F4E   C3 BE 15           JNP     ERROR            ;'=' EXPECTED!NOTE: NO
1F51   3E 16       ER16:  NVI     A,16H            ;FOR INDICES)
1F53   C3 BE 15           JNP     ERROR            ;BAD SYNTAX NEAR 'TO' O
1F56   3E 17       ER17:  NVI     A,17H            ;IN FOR STATEMENT
1F58   C3 BE 15           JNP     ERROR            ;FOR'S NESTED TOO DEEPL
1F5B   3E 18       ER18:  NVI     A,18H
1F5D   C3 BE 15           JMP     ERROR            ;'NEXT' EXECUTED BEFORE
1F60   3E 19       ER19:  NVI     A,19H            ;NESTING ERROR, 'FOR'-'
1F62   C3 BE 15           JMP     ERROR
1F65   3E 20       ER20:  MVI     A,20H            ;BAD INDEX IN FOR-NEXT
1F67   C3 BE 15    ER21:  JNP     ERROR
1F6A   3E 21           :  MVI     A,21H
1F6C   C3 BE 15           JNP     ERROR
                           END
NO PROGRAN ERRORS
```

SYNBOL TABLE

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* 01
A       0007    ADDO    1A56    ADFLD   1812    AFUND   190F
AGA     1AD2    ALPHA   1222    AR      1614    ARCK    1B89
ARYES   1BCD    ASBC    1A59    B       0D30    BAC     1220
BINOP   1A3B    BMPTR   1988    BNDL    156C *  BND2    15A3
BND3    15A6    BUTNS   21AA    BOUNO   1540    BUPT    1B90 *
C       0001    C1      1219    CALLP   1D5A    CNAR2   0FE7
CNARS   15D8    CANEKE  1981    CHK1    12A3    CHKND   1987
CLSUB   1DCC    CONT    1778    CONV    0FE5    CUPD1   17AE
COPDH   17AB    CPNT    215B    CREG    21B4    CV8     122A
CV81    124B    CYB2    1698    U       0002    DCOMP   0FF1
DFXL    0FDC    DIM     1720    DIV     1ABD    DLOOP   1726
DOL     19EC    F       00D3    ECAV    1901    END0    16F2
ENTRY   1671    EOK     19EA *  ER10    1C7B    ER14    1A3
ER15    1F81    ER17    1E86    ER18    1F8B    ER19    1F90
ER20    1F95    ER21    1F9A    ER6     172C    ER7     1BEB
ERB     1A22    ER9     1F7C    ERLN    15DF    ERRET   1BC8
ERRUR   15BE    ERRW1   15U2    EVAL    19C7    EKPRE   1AD6
FI      144E    FALSE   1D1Z    FBAC    1B76    F81LD   1E68
FCUMP   1D23    FDAT    196F    FEKST   1E8D    FINPT   0FEB
FIX     1915    FLDFD   182D    FLINT   2190    FMULT   1A87
FNDSB   1DBE    FONE    1ED5    FOR     1DE7    FORID   1441
FOR11   1440    FOR12   143F    FORN1   1448    FORM2   1447
FORM3   1446    FORN4   144S    FORN5   1449    FORM6   144F
FORM7   1444    FORN8   1443    FORN9   1442    FOUND   12A0
FPERR   1A5B    FREG1   217C    FREG2   21B0    FSYM    1600
FWAN    21AA    GET     1709    GKEY    16C6    GOOD    1932
GOSUB   1D00    GOTO    1700    GREG    2177    GSENT   1703
GTRA    1709    H       0004    NLINP   2186    HONE    1824
MSRIN   1405    IAGA    1C8D    IBUF    2101    ICP2    160S
ICP4    1600    ICP7    15F6    ICP8    15F8    IUONE   19B3
IEND    1B8C    IFRT    1G7D    III     1CA8    ILOOP   168C
INCPT   1607    INP     1973    INPER   1B40    INPOK   1B89
INPUT   1B4C    INSER   108F    ISR10   1168    ISR11   1171
ISR12   117A    ISR1A   10A2    ISR1I   10BD    ISRT2   10C4
ISRT3   1004    ISRT4   1007    ISRT5   110F    ISRT6   1121
ISRT7   1144    ISRT8   114B    ISRT9   1152    JT8L    1606
KASE    2160    KDAT1   134F    KDAT2   1364    KDAT3   139E
KDAT4   13CD    KDATA   134B    KFPNT   2158    KL2     2152
KL4     2154    KL6     215B    KLEN    2156    KLINE   2152
KONT    183B    L       0005    L1      15AE    L2      1288
LADD    0FD0    LDIV    0FD6    LEN     2161    LENGT   1271
LET     1B0D    LIS1    11EA    LIST    1101    LMCH    0FF8
LNUL    0FD3    LOK     1AED    LPNT    2152    LSUB    0FO9
LUKON   1627    M       0006    N1      1000    M1A     1013
M2      1016    M3      1D1F    M4      1D62    M4A     1D47
MCHK    0FF4    MDBC    1A9D    MEMEN   27FF    MENFU   1514
MEMST   2100    MESCR   2188    MINSE   193D    MODE    2185
MODE1   1997    MORE    1B7F    MULT    0FE8    MULT1   2162
MULT2   2166    MODU    175F    NEST    2194    NEXT    1E09
NEXT1   1EFD    NFPER   1A7E    NL2     2140    NL4     214F *
NL6     2151    NLE1    1275    NLE2    1284    NLINE   2148
NOENT   1646    NOLIN   1191    NOMAT   1638    NOSYM   1644
NOT3    1008    NSRCH   1288    NSTOK   1EC2 *  NUN8    1214
NUSUB   1070    NXTON   1F74    NXTSP   2159    OBUFF   2100
ODA10   14CB    ODAT1   1464    ODAT2   146A    ODAT3   1478
ODAT4   14B1    ODAT5   1488    ODAT6   1491    ODAT7   14A0
ODAT8   14B7    ODAT9   14C2    ODATA   145A    OKK     1847
OKLET   1731    OKN     1715    ONHO    1825 *  OUTR    1788
P1      1288    P2      12C2    PAD     12A0    PARLP   1090
PENO    1846    PIN1    140B    PIN1A   140E    PIN3    1500
PINST   1C73    PK1     1418    PK2     1435    PL2     2158
PL4     2150    PL6     215F    PLINE   2159    PLOOP   1A4E
PREXP   1085    PRI     1A95    PRI1    1C63    PRNPT   189C
PRT1T   1AE0    PSW     0006    PT1     106U    PTAPE   1065
PTFIN   1C4C    PTVAL   0FEE    QCHEK   1AC8    QOTOK   1A8D
QSTR1   1430    QSTRG   1428    QTCHK   120E *  QUITT   1208
QUOTE   1A84    ROKON   1853    RELAT   1CD5 *  RETRN   10E5
RINST   1836    RUN     1678    S2      1307 *  S3      1308
S4      1323    S4A     1322    S5      133F    SAVV    1C32
SBSAV   2150    SCI     1876    SCALR   1881    SCMEM   21A0
SCOLN   1807    SCR     2166    SEND    0006    SFSG    1894
SINEO   1D38    SLOAO   18AA    SONWD   1839    SORCE   169A
SP      0006    SPACE   1981    STAC    2196    STLIN   2149
STNER   18C8    STOKK   18AF    STOKV   18A0    STP     1E56
STPNT   1188    STRIN   1892    STSIZ   0014    STSPA   2148
SUBB    1A81    SUBS    21AC    SYMSR   12E7    TAPE    11AA
TMEN    1019    TIN1    13CC    TIN2    13F6    TIN4    1409
TIN4A   1408    TIN5    1401    TIN5A   1404    TOPNS   2196
TRUE    1D16    TTYIN   13C9    V1      1815    VALUE   17C3
VAR     1860    VARAD   218A    VEND    21AA    VLOC    2138
VNAME   218C    W1      120F    W2      12FO    WFOR    1A27
WFPER   1A77    WNAT    119E    WR1T    120D    WRIT1   1202
ZROL    0FCD
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